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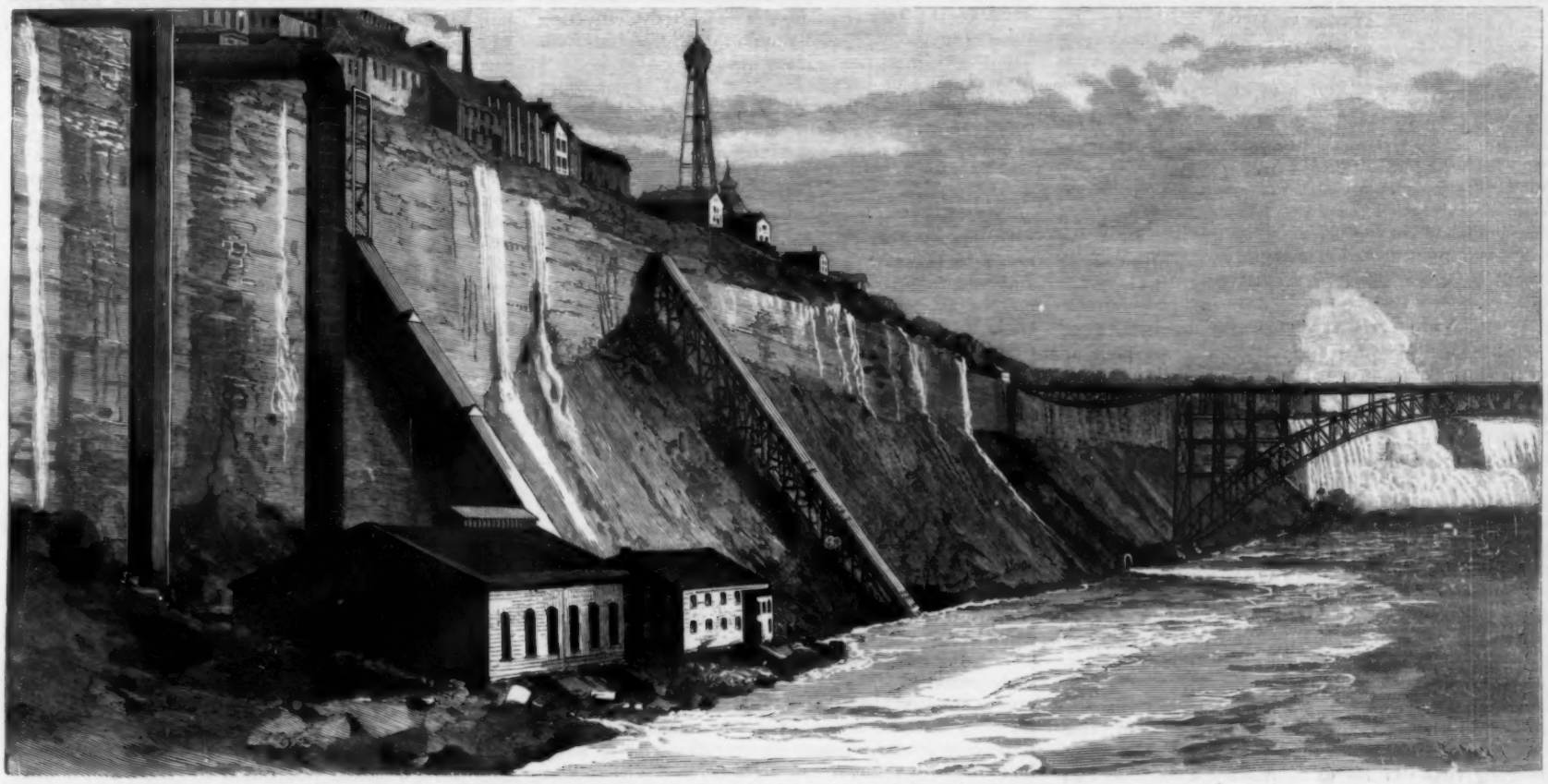
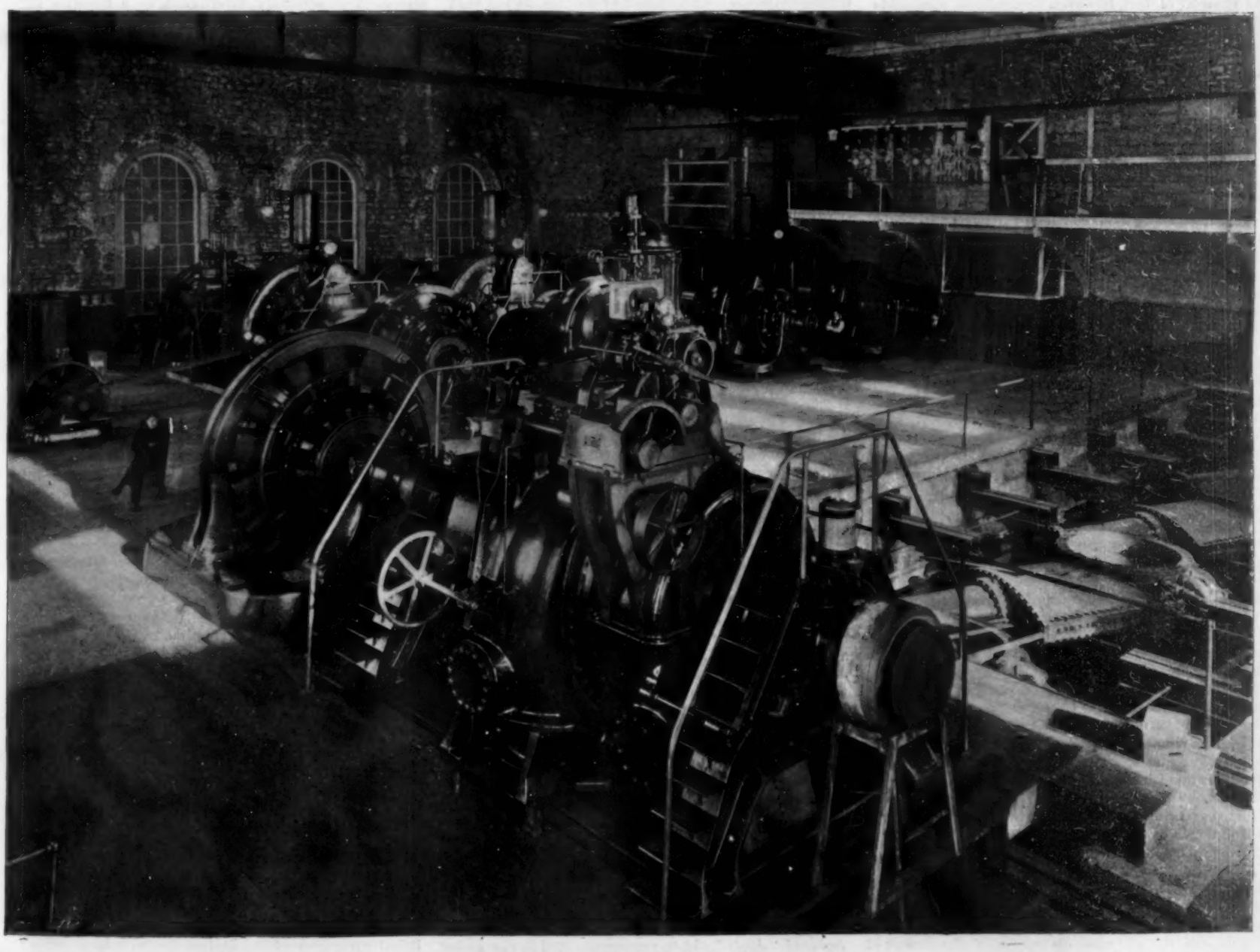


View of the Power House, Looking Up the Gorge Toward the Falls.



Interior of the 20,000 H. P. Power House.

NIAGARA FALLS HYDRAULIC POWER PLANT.—[See page 310.]

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NEW YORK, SATURDAY, NOVEMBER 11, 1899.

THE ELECTRIC POWER PROBLEM OF NIAGARA.

With the article which appears on another page of this issue we close the series, on Niagara Falls as an industrial center, which has appeared at intervals during the present year, and it will now be opportune to sum up the results which have been accomplished, and see how far they agree with the expectations which were formed when the "harnessing" of the Falls on the present extensive scale was seriously undertaken.

In the first place it must be understood that the generation of fifty thousand electrical horse power was not attempted primarily with the expectation of transmitting it to far distant centers, there to be redistributed for local use. It is true that this was popularly supposed to be the object aimed at in the Niagara Falls Power Plant, and in the early days of its construction, writers were accustomed fairly to revel in picturesque descriptions of the silent flow of Niagara's energy to cities as far distant as Chicago and New York, where it was to displace every existing form of power by virtue of its extraordinary cheapness and convenience.

As a matter of fact, however, the eminent specialists and financiers who had the courage to build such a vast electrical plant did not undertake to generate this unprecedented amount of electrical energy with the idea of transmitting it *in toto* to far distant centers. Not only was the art of long distance transmission at that period in its comparative infancy, but it was foreseen that better economic results would be achieved in bringing the industries to the source of power rather than in carrying the power to the industries. As between the two alternatives, there were on the one hand the great cost and losses of transmission, and, on the other, the question of cheap railway and steamship transportation both for the raw materials and the finished product. The original promoters considered that, in respect of transportation facilities, the proximity of the Great Lakes and the convergence of several important railroads at Niagara rendered this an ideal manufacturing center, and, acting upon the conviction, they purchased large blocks of land contiguous to the power station, with the intention of renting the same for the erection of industrial establishments, which in the course of time were certain to be attracted by such an abundant electrical supply. At the same time, the company wisely determined to design the electric installation with a view to meeting the varied needs of its customers, and arrangements were made to supply, within reasonable limits, any kind of electric current that might be required.

That the expectations of the company were well founded is seen from a study of the facts presented in the series of articles in the SCIENTIFIC AMERICAN above referred to. In the few years that have intervened since the water was first turned into the wheelpit of the Niagara Falls Power Plant, a large number of entirely new industries have sprung up around, or within easy touch of, the station; while establishments that were already existing have become extensive users of the power. That the tendency is for the industries to gravitate to the power rather than the power to be transmitted to the industries is shown by the fact that out of a total of 35,000 horse power delivered from the station, over three-fourths are consumed in its vicinity, as against less than one-fourth that is transmitted to a distance—the principal long distance transmission being that of 8,000 horse power to Buffalo, for the use of the Cataract Power and Conduit Company.

Although the natural trend of events, controlled by well understood economic laws, has brought about a centralization of industries at the falls, it is not to be inferred that long distance transmission will not enter largely into the ultimate utilization of the energy of Niagara. In the few years since construction was first started a great stride has been made in art of generating and manipulating electrical currents for transmission, and the remarkable installation recently opened in Southern California, where a transmission of 83 miles has been successfully accomplished, suggests that a large part of the 7½ millions of hydraulic horse power available at the falls may yet be transformed and transmitted to the large cities of the East. The present indications are, however, that for some time to come transmissions are not likely to be attempted for distances of over 100 miles. The difficulties are not now so much of a physical nature (thanks to the alternating current of high potential), but are largely economical—the great cost of the line rapidly offsetting the cheap cost of production at the power station. The power from the falls could to-day be transmitted to a distance of 100 miles with a loss of 20 per cent; and in spite of this loss and the great cost of the line, it could compete successfully with steam power at a cost of $60 per horse power per annum.

COMMISSIONER DUELL ON TRADE MARKS.

By the courtesy of Commissioner Duell we are enabled to present on the adjoining page an address which he recently delivered at the International Commercial Congress at Philadelphia on the subject of trade marks. From the wide range of subjects connected with his work as Patent Commissioner, Mr. Duell chose for his address one which is particularly applicable to the remarkable expansion of our foreign trade which is now taking place. He makes out a strong case in favor of the use and registration of trade marks, both as an incentive to our manufacturers to maintain the high quality of their exported goods, and as a protection against foreign competitors who may attempt to pass off a poor imitation as the genuine article. The statistics of our exports, as quoted in the address, show that the introduction of American manufactured products into foreign countries is advancing by leaps and bounds, our exports for the first nine months of the present year being $280,000,000, as against $230,000,000 for the same period in the year preceding, an increase at the rate of about $67,000,000 for the whole year. It should certainly be the first duty of our manufacturers to see that these goods, representing over a quarter of a billion dollars in value, are sent abroad under the fullest trade-mark protection that the law can give. As an indorsement of the Commissioner's recommendation that manufacturers who ship abroad should adopt a trade mark, we may mention that to the writer's knowledge a private inquiry which was lately conducted developed the fact that an astonishing proportion of the goods exported bore no distinct trade mark. The evil of this omission is seen when we bear in mind the fact that foreigners unacquainted with the English language are unable to distinguish the mere manufacturer's name from other English words on the goods; whereas they would readily acquaint themselves with a distinctive name or trade mark. As an addition to the Commissioner's suggestion, we urge that trade marks be not only adopted, but that they be registered in foreign countries. Non-registered marks in foreign countries are unprotected, and as a matter of fact a competitor may register another's well-known mark and deprive the original owner of his rights.

It is a curious fact, the explanation of which we will not enter upon just now, that there are many firms which have adopted and have been using for many years trade marks that they have failed to register. It has sometimes happened (a case of the kind having recently come under our notice) that a firm has adopted a trade mark which was already registered and in extensive use for the very same article—a condition which could never have existed had the firm in question gone to the trouble of registration, one of the chief benefits of which is that in the process of applying for registration at the Patent Office, a thorough search is instituted to make sure that the particular mark has not already been registered. The case referred to above is that of a milling firm, which, after using for over twenty years a certain mark for its flour, applied for registration and found to its dismay that the identical mark had been in registered use by another reputable firm for over a quarter of a century. As it happened, the matter was arranged agreeably to the interests of both parties, but it can easily be seen how the valuable reputation acquired in twenty years' use of this particular mark and the many thousands of dollars which had been spent in advertising might have been completely lost to the firm.

The moral of this particular case, which could doubtless be duplicated many times over, is that a manufacturer should not only register at once the trade marks that he may have had long in use, but also any new mark which he has just adopted.

The selection of a trade mark is not by any means the simple matter that many people suppose it to be, and we strongly recommend that in making such a choice, the manufacturer carefully read over the series of "don'ts" which are enumerated in the latter part of Commissioner Duell's address.

BUREAU OF ORDNANCE ON THE ARMOR QUESTION.

When a congressional committee deliberately ignores the recommendations of the technical bureaus and undertakes to speak *ex cathedra* on a purely technical question and say that this can and that cannot be done, the interests of the country are sure to suffer. As a result of the limitation of the price that may be paid for armor for our battleships and cruisers, which was brought about by the action of a few committeemen in the last Congress, the good work of building up our navy is to-day in danger of being brought to a positive standstill. This serious state of affairs is brought out in the annual report of Rear Admiral O'Neil, chief of the naval bureau of ordnance, who says: "It is quite evident that the building of armored ships of war must soon be discontinued by this government until the vexed questions of the source of supply and cost of armor are disposed of."

The present condition of the matter of armor supply is as follows: The contracts for the "Kearsarge" and "Kentucky" have been completed, and the Harveyized armor for the battleships "Alabama," "Illinois," and "Wisconsin" is now being manufactured. Of the total amount required, 2,481 tons yet remains to be delivered, but it is likely that the contracts will be completed by the close of the year. In the case of the three battleships of the "Maine" class, authorized over a year and a half ago, and of the three battleships and three armored cruisers authorized last winter, no provision whatever for armor has been made, a clause having been inserted in the bill authorizing the six battleships and cruisers forbidding the closing of any contracts for the construction of the ships unless their armor could be secured for $300 per ton.

The determination of Congress to say what price shall be paid for armor is responsible for the whole delay, and its attitude on this question has been marked by a disposition to have its own way, regardless of the actual facts of the question, which does more credit to the obstinacy than to the judgment of the two or three committeemen who have been responsible for a positive deadlock in the construction of the navy. The policy of obstruction was commenced in connection with the ships of the "Alabama" class, when Congress placed the absurdly low limit of $300 per ton upon the price to be paid for the required Harveyized armor. Of course no bid was forthcoming, and it was only when Congress had raised the limit to the reasonable figure of $400 per ton that contracts could be closed. This arbitrary interference in a question on which it should have been guided by the advice of its technical bureaus resulted in a delay of one year and nine months.

Congress is now confronted with the question of providing armor for the six battleships of the "Maine" and "New Jersey" classes and the three new cruisers. There would be no difficulty in closing contracts for the supply of Harveyized armor at once at the price of $400 per ton; but the Harvey product, excellent as it was in its time, is not the best armor that can be made to-day. It is greatly inferior in its ballistic qualities to the Krupp armor, which is manufactured by a process that is an improvement upon the methods of face-hardening adopted by Harvey. Manufacturers of nickel-steel Harveyized plates will only guarantee them to stand ballistic tests up to a certain point, the uncertainties in the process being such as to prevent the guarantee being extended any further. The Krupp process is more certain in its results, and not only can the face-hardening be carried further into the plate, but the body of the plate is tougher throughout its whole depth and possesses remarkable ability to resist cracking and hold together under repeated impacts. At the same time these superior qualities are secured at a greater difficulty of manufacture, and a smaller quantity can be turned out in a given time than by the Harvey process.

The armor question will be one of the very first to engage the attention of Congress at its next session, when it will be confronted with the alternative of raising the limit of cost to something like $500 a ton, or clothing the latest and finest ships of our navy with armor which is greatly inferior to that employed by the other navies of the world. The limiting clause which prohibits the construction of the new ships until armor shall have been secured at a price of $300 a ton is so supremely ridiculous in the eyes of all practical men that the merest promptings of self-respect should lead Congress to rescind the objectionable clause and pass a more rational measure.

The price asked for Krupp armor is not, in view of the first cost of the plant, the risks of manufacture, and the smallness of the output, excessive. It is being paid willingly by the European governments, and costly as it may seem, the magnificent protective qualities of the plates render them, ton for ton, as cheap if not cheaper than those manufactured under the old process.

AMERICAN EQUIPMENT FOR THE CITY OF GLASGOW.

In the midst of much heated discussion of the political expansion of the United States, it is refreshing to see with what rapid strides the commercial expan-

sion of the country is taking place in every part of the world. This is a species of invasion, upon the ethical and economical aspects of which we are all pretty well agreed; and on the receipt of each bulletin announcing the success of the foreign representatives of our great industrial concerns in winning orders against strong local competition, we may well feel a touch of patriotic pride.

The latest and most significant instance of our invasion of foreign territory is furnished by the contracts which several American firms have secured for furnishing the plant and equipment for the Glasgow municipal tramways. The National Cable and Conduit Company is to supply and build the cables and conduits; the E. P. Allis Company the engines; the General Electric Company the electric fittings, and the first one thousand cars are also to be supplied by an American firm. The total value of these contracts is said to be in the neighborhood of $15,000,000.

COMMISSIONER DUELL ON TRADE MARKS.*

The subject under discussion to-day is an important one, not only so far as it relates to domestic trade and commerce, but it is of even more importance in its bearing upon foreign commerce, which is the subject we are all most interested in at the present time. The manufacturers and merchants of this country must find an output for their products in the markets of the world, and that they are beginning to realize this is clearly shown by the statistics in reference to the export of manufactures. Nine months of the present calendar year show that such exports amounted to very nearly $280,000,000 against nearly $230,000,000 in the nine months of 1898. These exports form over 31 per cent of our total exports, as against less than 27 per cent for the corresponding months of 1898. Anything, therefore, which adds to our power to hold and increase this remarkable showing is of the utmost importance.

In the first place, to secure a large foreign trade we must manufacture the goods that foreign nations demand. They must be unexcelled in the materials of which they are made, and in the manner of making and packing them. When the trade is once established, it can be only retained by continuing to send a grade of goods equally as good as those first sent. How important is it then that the exporter, in sending forward his goods, should have them so marked and distinguished that when the mark becomes known, no one can palm off an inferior grade of goods as the product of the one who has established the business. It becomes essential, therefore, that exporters should adopt and use trade marks.

From the earliest days of recorded history it has been the custom of men to indicate their proprietary rights in all kinds of movable property by the use of individual brands, marks and other insignia of ownership. As trade and commerce extended and ceased to be local, it became more important for the manufacturer and merchant to distinguish their goods from those of others. At first, signs and symbols, such as representations of animals, stars, shields, crescents, and the like, were employed. As man ascended in the scale and education became more diffused, coined words were employed, but, whatever the mark selected, it should be one which is a lawful trade mark, the right to which can be maintained against any and everybody.

The exclusive right to property in trade marks has been recognized by all civilized countries for many years; and as the importance and necessity for preserving proof of the adoption and use of marks became more important, statutory provisions for the registry of such marks have been enacted by most of the countries of the world. The first national trade mark law in the United States was adopted in 1870. That act was declared unconstitutional by the Supreme Court. Up to that time some 8,000 trade marks had been registered in the United States Patent Office. In 1881 a new trade-mark law was enacted under which nearly 25,000 marks have already been registered. That the present law needs amendment is universally admitted, but I will leave for others the discussion of the question as to how the law should be amended.

Notwithstanding the large number of marks that have been registered in the Patent Office, thousands of alleged trade marks presented for registration have been refused because they did not disclose matter that was susceptible of exclusive appropriation, and this leads me to the point to which I desire most earnestly to call your attention. The advice will consist largely of "don'ts," although it will not be as sweepingly used as Punch's advice to the young man about to marry.

Do adopt and use trade marks, not only for your domestic but for your foreign trade. When you select a mark, be very careful that it is a lawful trade mark, and one to which your right is undeniable.

Don't adopt your own name as a sole mark for your manufactures. Every man undeniably has a right to use his own name upon his own goods to indicate their origin and ownership and as a guarantee of their quality and character. This right is common to all men, and, therefore, if there are twenty men by the name of John Adams, each one of the twenty has as good a right as any of the others. True, he cannot use his name in an unlawful manner, and from such use he will be enjoined, but a mark which consists merely of the name of the party using it is a very weak reed upon which to rely.

Don't adopt a geographical term. The Supreme Court of the United States has repeatedly held that no one can exclusively appropriate to his own benefit a geographical term so as to prevent others inhabiting the same or similar territory from dealing in similar articles. It is true that the decisions of the courts have not been uniform on this subject, but in every case, with possibly one or two exceptions, where the exclusive right to use a geographical term has been sustained, some peculiar facts have led to the decision. If you wish to keep out of litigation, don't select a geographical term for your trade mark.

Don't adopt a descriptive word or name. It has been held by the courts times without number that words or names simply indicating the quality or ingredients of the articles cannot be appropriated so as to prevent others from employing the same words upon the same articles.

Don't adopt a word expressing quality, grade or peculiar excellence. No man has the exclusive right to use any word or symbol which merely indicates the excellence of his article. No more has he the right to exclusively appropriate for his products marks, letters, numbers, or words which actually indicate the grade of the article. While I cannot say don't adopt a suggestive word (for such a word will generally be sustained by the courts), the greatest care should be used or you will enrich some member of my profession.

It is so easy to select a device or symbol or to coin a word that there is no reason why a manufacturer or merchant should select as his mark anything which is not a lawful trade mark or which is on the border line, and will in all probability ultimately land him in the courts. So many alleged trade marks are presented at the Patent Office for registry, and those not being lawful trade marks have to be rejected, that I have felt impelled to make use of this opportunity to utter this note of warning.

Through our labor-saving inventions we are able to produce manufactured articles as cheaply as they are produced in many other countries where wages are much lower. If then our manufacturers send out only such of our manufactured products as suit the tastes and requirements of the people to whom they sell, we cannot fail to greatly extend our export trade in manufactured articles; and, when once established, if we have adopted and used lawful trade marks to indicate our ownership and title, there will be no reason why the trade, once gained, cannot be kept indefinitely.

* Address delivered at the International Commercial Congress, at Philadelphia.

SEARCHLIGHTS FOR THE NEW YORK FIRE DEPARTMENT.

The New York Fire Department is about to add a complete portable electric searchlight plant to its apparatus. The searchlight wagon will go to fires with the engines, etc., and it is believed it will add greatly to the efficiency of the force, both in saving life and property. It resembles a fire engine in general appearance, but instead of a pump it has an engine and dynamo. There are two searchlights each with an 18-inch lens. These will be carried on a platform behind the driver's seat. They can be used either from the platform or removed and carried to any desirable point of vantage, all communication with the generator being kept up by means of flexible cables which are insulated with rubber. The lights are provided with devices for quick regulation so that the light may be spread out over a wide area or confined and directed to any particular point. The purpose of the apparatus will be to light up dark parts of the street and aid the firemen in laying the hose, setting ladders, etc., also to light up the front of buildings where people may be in danger and to project light into the buildings themselves.

THE NEW GOVERNMENT PRINTING OFFICE.

The new government printing office will cost about $2,000,000, and it is said that even after its completion it will not be large enough to meet the demands upon it. The new building will be eight stories in height, and its floor space will be about nine acres. The floors will sustain a load of 85,000,000 pounds. The building will be constructed in such a substantial manner that nearly the entire space can be filled with paper and books without injuring its stability in any degree. Access to the various floors will be obtained by twelve electric elevators. The building will be lighted with 7,000 incandescent lights. A refrigerating plant will furnish cold filtered water on every floor for drinking purposes. A large crematory will destroy all the refuse material, and this will aid in heating water, etc. It is hoped in time that Congress will appropriate the money for modern typesetting machines, but it is probable that when the census is complete and the reports published, the equipment of the census printing office will revert to the government printing office.

OUR CALIFORNIA NATIONAL PARKS.

The report just made to the Secretary of the Treasury by Second Lieutenant Henry B. Clark, the acting superintendent of the Sequoia and General Grant National Parks, in California, deals in an interesting manner with the problems under his control. During the past fiscal year much devastation of timber by forest fires and of game by unlawful hunting has been unpreventable by the force under his command, because of the necessary removal of the regular military patrol for war service and the entirely inadequate force of civilian custodians appointed in their place. It is estimated that over 200,000 sheep have been roaming at will over these reserves, private property fed at public expense; and by these many of the nests of game birds have been trampled out and much of the herbiage needed by the elk and mountain sheep has been consumed. The latter two species have practically all been killed off, and other smaller game, now in greatly decreased quantities, will be preserved with difficulty unless immediate and energetic steps are taken. Mountain lions, panthers, coyotes, several varieties of fox, black, brown, and cinnamon bear, deer, mountain and valley quail, and many species of fish are still quite abundant; and probably the carnivores in this list are holding their own. Speaking of the mighty forest monarchs of the General Grant Park, Lieutenant Clark says:

"The tree General Grant was named in honor of the general while he was still in command of the armies in 1867. The stump and log of the immense tree exhibited at the Philadelphia Centennial are well-preserved objects of interest. Another log has been so burned that a cavalryman can ride through its whole length, 125 feet. The stump of the World's Fair tree is to be found north of the Grant Park. The largest tree in the Giant Forest is the General Sherman, 34½ feet in diameter at its base. This is conceded to be the largest and finest tree in the world, rivaling the eucalypti of Australia in height, and far surpassing everything else in bulk. Another clean and healthy sequoia, which has stood sentinel over the Sierras and the Pacific for more than a thousand years, is called the Admiral Dewey. Visitors are generally content to stand uncovered and almost mute from respect to these dignified monarchs of our forests."

NEW METHOD OF DETECTING GOLD.

A new method of detecting the presence of a small quantity of gold has been recently discovered by Dr. Ohler. By this method the presence of quantities as low as 77 centigrammes per ton may be established. The operation is as follows: A quantity of finely powdered ore, say 120 grammes, is introduced into a flask. To this an equal volume of tincture of iodine is added, and the mixture well agitated. It is then left for an hour, agitating from time to time, and is finally allowed to stand. When the solution has separated, a band of filter paper is saturated with this, and the paper allowed to dry. This operation is repeated five or six times in succession, in order to completely saturate the paper. It is afterward calcined, and it will be observed that the ash, when gold is present, offers a purple color. This color should disappear quickly if the ash is moistened with bromine water. The test may be modified in the following manner. A quantity of the powder, 120 grammes, is covered with bromine water, and after agitating during the course of an hour, the solution is filtered. Upon adding protochloride of tin to the solution, it takes a purple color, in the presence of gold, giving the reaction known as "Purple of Cassius." In the case of sulphides the ore should be previously roasted, and when the mineral contains a considerable proportion of carbonate of lime, it should be calcined in the presence of ammonium carbonate.

USES FOR CORN STALKS.

Half a dozen years ago the farmer considered the value of his corn crop to be practically terminated with the husking of the corn. What was left was worth a very small sum an acre as fodder. Many experimenters, however, working along different lines have established the value of the by-products of the corn crop, and there is now a home market where a farmer can get from $3 to $5 a ton for corn stalks, so that their value is now from $6 to $12 an acre.

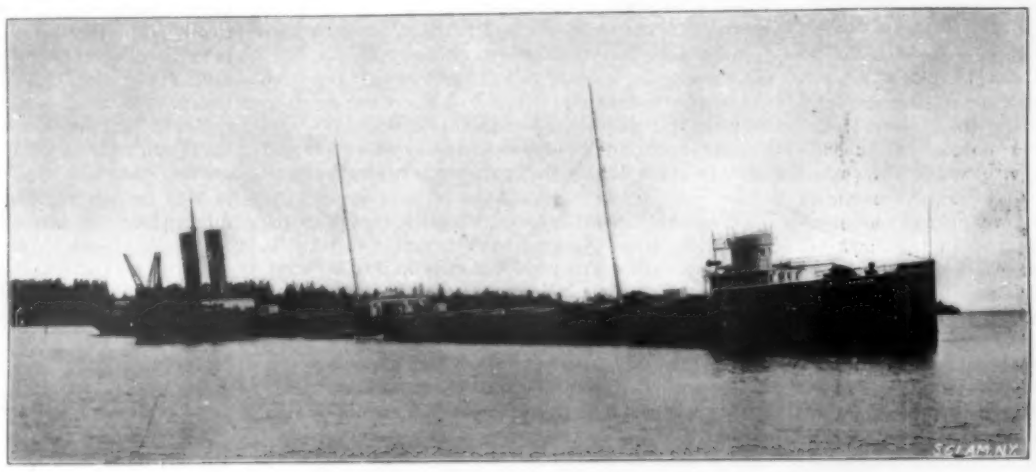
The American Agriculturist recently gave the following list of what can be made from corn stalks; first, cellulose for packing coffer-dams on our ships; second, pyroxyline varnish; third, cellulose for nitrating purposes for making smokeless powder and other explosives; fourth, as a packing material; fifth, for paper pulp and the various forms of paper made therefrom, both alone and mixed with other grades of paper stock; sixth, as a stock food made from the fine outer shells or shives of the corn stalks and also from the nodes, or joints. The leaves or tassels also furnish a shredded or bale fodder; seventh, mixed feeds for stock containing fine ground shell or shives as a base and in addition thereto various nitrogenous materials and concentrated food substances, or blood, molasses, distillery and glucose refuse, sugar beet pulp, apple pomace and other by-products; and eighth, poultry foods.

PROBLEMS IN LAKE COMMERCE.

BY WALDON FAWCETT.

The problems involved in the successful conduct of the commerce of the great lakes have grown in complexity within the past few years in a degree fully proportionate to the marvelous extension of the shipping interests of America's inland seas. This year, of all others, the vesselmen were anxious that no derogatory influences should check or retard the flow of traffic, and yet in some respects they have fared even worse than usual.

A moment's consideration of the conditions existent in the commercial and manufacturing world will demonstrate the growing importance of that link in the industrial chain formed by fresh water transportation interests. With almost the entire year 1899 a continuous record of advancing prices in all the commodities of iron and steel, culminating finally in a condition nigh approaching a famine, thousands of men have bent their best energies to moving, from the country bordering on Lake Superior to the furnaces in the vicinity of Pittsburg and the Mahoning Valley, every ton of iron ore procurable for shipment.



WRECK OF THE "DOUGLASS HOUGHTON," SAULT STE. MARIE RIVER, MICH.

Everywhere there has been co-operation in the movement. The mine operators time and again advanced wages in order to compete with the opportunities afforded to labor by the harvest fields of the Northwest; the railroads which carry the ore from the mines to the boats and from the boats to the furnaces have worked energetically to prevent a car famine; and the dock plants which load the ore at one end of the lakes and those which unload it at the other have been operated day and night. After all, however, the final responsibility rested with the vesselmen.

To be sure, the shipping interests have been well paid for the energy which they have displayed. The stringency of the demand for the movement of ore forced up the freight-carrying rates by rapid jumps to a point where the charges for the movement of a ton of ore or coal were three or four times what they had been at any time in years. On the basis of a $2 per ton freight charge on ore, one of the largest type of steel vessels now in service on the lakes is able to net her owner pretty close to $15,000 for each trip; and when it is remembered that under ordinary circumstances a vessel will make at least twenty round trips in a season, it will be seen that the profits of a fleet of half a dozen vessels for the year 1899 may amount to a very tidy sum, even if the craft simply carry ore on the trips down the lakes and return "light," as the vesselmen say. Then, too, the owner, if he desired to consume a few days in loading and discharging cargo, has had no difficulty in securing cargoes of coal to take back up the lakes at a rate of anywhere from 50 cents to $1 per ton.

The chief obstacles to the smooth conduct of great lake commerce continue to be found, as for years past, in delays owing to low water and inconvenience arising from accidents to vessels in the narrow tortuous passages which connect several of the lakes. Instances of the former have been particularly numerous this year, owing to the disposition of vesselmen to load their boats as deeply as possible, but of this I shall have a word to say later.

The lessons of the present season upon which particular emphasis has been placed are those illustrative of the disadvantages attending accidents to boats, which by their character proved a general menace to navigation. Lakes Erie and St. Clair, St. Clair and Huron, Huron and Superior are connected by rivers and canals, so narrow in spots as to barely permit of the passage of boats bound in opposite directions. The work of getting these channels properly buoyed and lighted has been a long drawn out effort for the vesselmen, but it is now all but completed. On its very heels, however, the advent of the larger boats which have been brought by the new era of lake shipping discloses a new danger in the narrowness of the streams.

The seriousness of the situation was brought forcibly to the attention of the people having to do with fresh water commerce by an accident about the middle of September, which was unique in the history of navigation on the inland seas. One of the busiest places on the whole chain of lakes is the Sault Ste. Marie River, which connects Lakes Huron and Ontario and through which there is transported each year more tons of freight than pass through the Suez Canal. At the time above mentioned the channel of this river was completely blocked at one of its narrowest points by the sinking of the great steel steamer "Douglass Houghton." Many times previously had a boat sunk in the channel of the Detroit or St. Mary's River compelled other craft to creep past her carefully, but never before was the whole commerce of the inland seas suspended by a complete and effectual blockade.

The "Houghton," which is one of the fleet of vessels owned by John D. Rockefeller, is upward of 500 feet in length, ranking as one of the largest freighters on fresh water. Passing down St. Mary's River she was towing the barge "John Fritz," a vessel almost as large as herself, and together they carried over fifteen thousand tons of ore. In making a sharp turn at a bend of the river the vessels collided and the "Houghton" sank, her huge bulk reaching from shore to shore. Although no expense was spared in the effort to expedite the wrecking operations on the sunken craft, the passage was blocked for almost a week, and in that time there gathered in the narrow river the greatest fleet which ever assembled on the great lakes and one of the most remarkable ever seen in America. In the more than two hundred vessels huddled together were represented almost every type of craft engaged in traffic on the lakes, and the forest of masts was almost as dense as the woods which extended to the water's edge on either side.

The breaking of the blockade was full of dramatic incidents. After wreckers and divers had worked day and night for some time it was decided to resort to dynamite, and even then successive charges were required before the limestone rock which held the boat was blown asunder. When the "Houghton" finally moved down stream she tore out like twigs the trees on the bank to which had been attached a twelve-inch hawser.

Clearing the channel proved, however, to be but a portion of the task, for thereafter came the management, within the confines of a winding river, of a fleet of two hundred of the largest craft under the American flag, save a few ocean liners. Officers of the United States revenue cutter service were placed in charge, and under their direction was formed the great procession of boats which, on the morning of the raising of the blockade, stretched out for more than forty miles from the scene of the wreck.

It is estimated that the blockade entailed a loss to lake shipping interests of fully a million dollars, and that the wrecking operations represented an expenditure of $100,000. The fleet which was delayed carried in the aggregate three hundred thousand tons of ore, twelve million feet of lumber, and nearly a million bushels of wheat. In its effect the blockade is bound to be far reaching. Already the shipping interests are preparing to make a most vigorous campaign before Congress for an appropriation to make navigable for the largest vessels a second channel in St. Mary's River, which up to this time has been utilized only by the smaller vessels. Between Lakes Huron and St. Clair is a ship canal where an accident such as occurred in St. Mary's River is a constant menace, and the project for a second channel here, which has been discussed for some time, will now be agitated with greater vigor than ever.

"WHALEBACKS" IN THE GREAT BLOCKADE, SAULT STE. MARIE, MICH.

Another great problem which the commercial interests of the lake region can no longer evade is that of the necessity for deeper water. Even as the great fleet, released from the blockade above mentioned, were hurrying in a mad race to make up lost time, many of them were delayed for hours by low water in the Detroit River. Moreover, the past two years has witnessed a scramble on the part of the great iron and steel producing interests to secure control of the tonnage on the lakes and build new. The new boats for which they have let contracts are interesting because they are in the neighborhood of five hundred feet in length—a size which, it was asserted a few years ago, would never be reached on fresh water; but more import-

ant still is the certainty that these new monsters, if fully loaded, will draw more water than is at present to be found in many spots.

Much thought has been given to this subject of late, and it has resulted in an entire revision of opinion. Heretofore the accepted policy has contemplated a deepening of channels by dredging, and millions of dollars have been expended in the work. Now comes the deep waterways commission—a body appointed by Congress several years ago—and declares for a great dam in the Niagara River. The commission makes the assertion that the expenditure of a million dollars for this dam will raise the level of Lake Erie three feet, Lake St. Clair two feet, and Lake Huron one foot. The practicability of the scheme seems to have been fully demonstrated, and a great effort is to be made to induce the next Congress to authorize it.

Even with these two main issues disposed of, other problems come crowding thick and fast. The plan of the railroads to bridge the Detroit River, at Detroit, which has been fought by the shipping interests for years, will soon come up again. A private corporation wishes to divert some of the water of St. Mary's River for power purposes; and, finally, a project has been mapped out for the construction of a canal from Lake St. Clair to Lake Erie, in Canadian territory. Any of these enterprises might seriously endanger navigation interests, and probably the next two or three sessions of Congress will witness some fierce contests with the development of the fresh water marine as their text.

German Sugar Production, 1898-99.

According to a statement published in the Reichsanzeiger of August 12, the quantity of refined and manufactured sugar produced in Germany during the campaign year 1898-99 (August 1, 1898, to July 31, 1899) was 1,186,686 tons, as compared with 1,207,350 tons during the campaign 1897-98. The quantity of raw sugar produced was 1,515,526 tons in 1898-99, against 1,664,268 in the preceding sugar campaign. The quantity of raw beets used in sugar manufacture is stated to have been 12,144,291 tons in 1898-99, and 13,697,891 tons in 1897-98.

AN AUTOMATIC HOOP AND BASKET STRIP CUTTING MACHINE.

The accompanying engraving represents a new automatic machine for cutting hoop and basket strips, which has been designed by the Defiance Machine Works, of Defiance, Ohio. The machine is arranged to prevent backlash and to reduce the noise of the rapidly moving cutter bar.

The machine is supported by a strong frame made of heavy cored sections of sufficient weight to prevent all vibration. Journaled in the frame is a main longitudinal shaft carrying fast and loose pulleys. On this main shaft beveled pinions are secured, meshing with bevel gear wheels, the shafts of which are transversely journaled in the frame. These transverse shafts are provided with eccentrics which support the ends of a sliding cutter bar.

When cutting strips of equal thickness the table is stationary, but when the strips or hoops are to be formed with a beveled side, the table is tilted, so that the blank stands at an angle to the descending cutter.

The table is formed of two transverse bars pivoted at their forward ends and provided with recesses in their sides, engaged by bolts on a link. The link is pivoted to a slide moving in a casing loosely hung on an auxiliary longitudinal shaft connected by gearing with the main shaft. Within each of the casings are cams on the auxiliary shaft. As the auxiliary shaft rotates, each cam raises its slide in order to swing the corresponding table bar into an inclined position for the knife to make a beveled cut. The cam is so formed that the blank on the table is alternately tilted during successive full strokes of the cutter bar, so that each alternate stroke causes the blank to receive a beveled cut.

The gearing connecting the main and auxiliary shafts is so arranged that the table automatically operates in exact time with the cutter.

In order to prevent backlash of the gearing and to diminish the noise, the cutter bar is provided at each end with a spring balance. The cutter bar on a down stroke moves against the tension of the springs so as to assist its return movement and to prevent backlash in the gearing. By using screw plugs attached to the ends of the springs, instead of the usual eyes or loops, the springs are rendered more durable.

THE Chicago City Council has passed an ordinance which provides for the establishment of a board of examining engineers, who will pass upon the qualifications of all applicants for a license to run an elevator. Prior to this action it was shown that most elevator accidents were due to incompetency on the part of the operator.

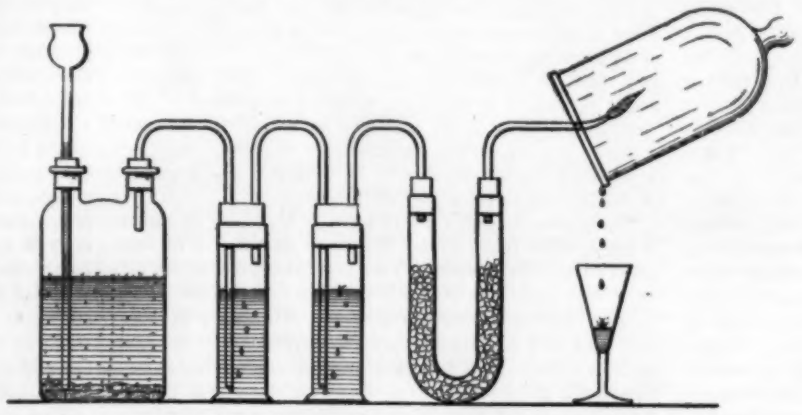


Fig. 1.—FORMATION OF WATER BY THE COMBUSTION OF HYDROGEN.

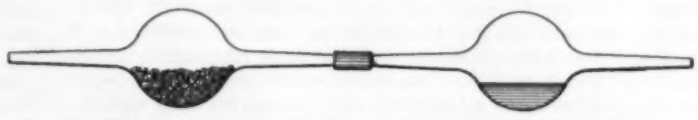
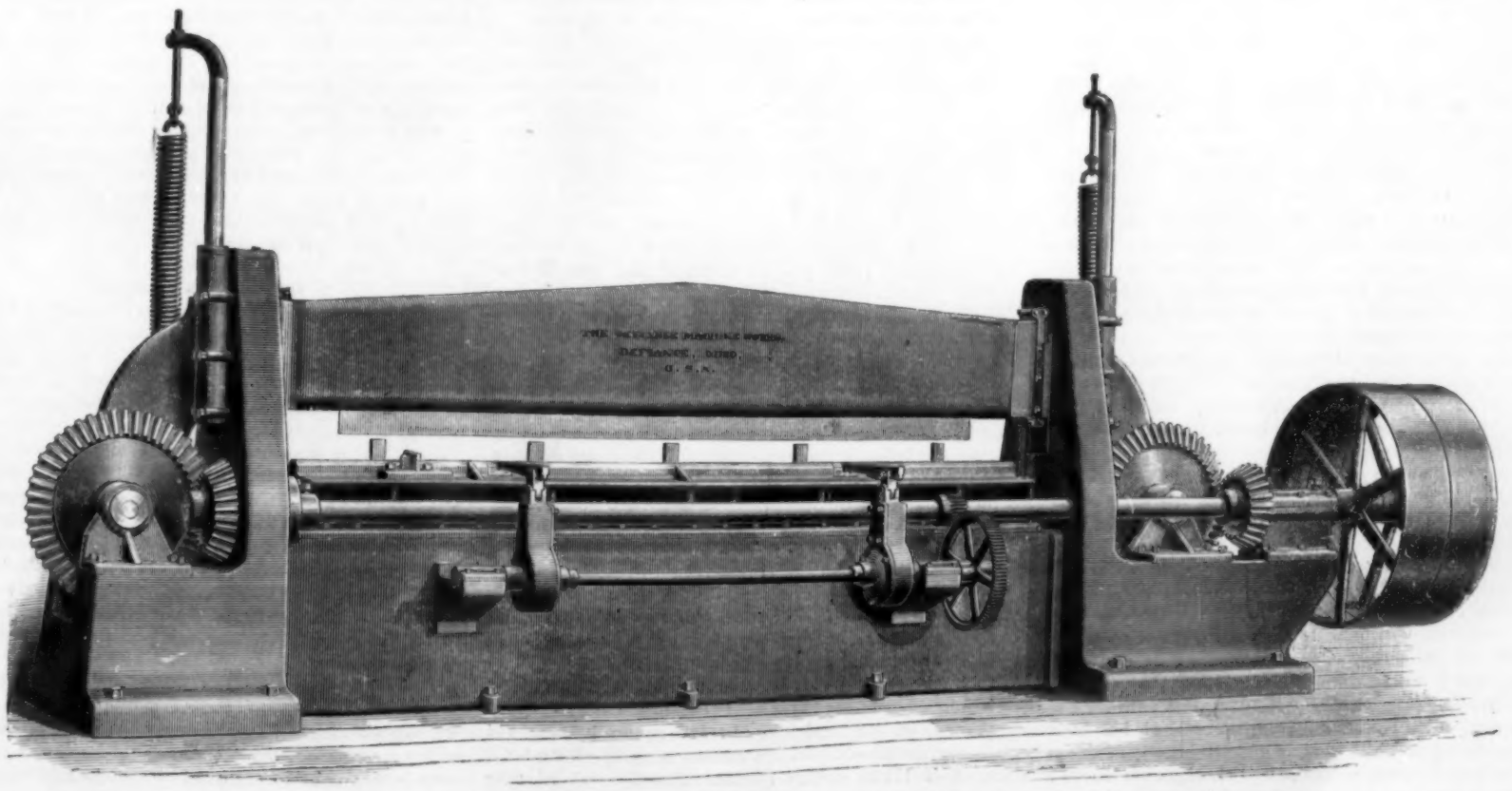


Fig. 2.—SIMPLE ARRANGEMENT FOR ROUGHLY CONDUCTING THE QUANTITATIVE SYNTHESIS OF WATER.

CASES OF "MYSTERIOUS" RUSTING.

BY N. MONROE HOPKINS.

The rusting of iron and steel is a familiar phenomenon to everyone, a source of great trouble and annoyance to those possessing fine instruments, tools, and machinery, and a factor in daily life of no mean economic importance. It is the purpose of this brief writing to point out to those who have not given attention to scientific chemistry the formation of water vapor by the combustion of gas, wood, or coal, and the condensation of the vapor to water when it comes in contact with cold masses of metal. An example will best make the matter clear, and throw light, perhaps, on many cases of apparently mysterious rustings. The writer was shown a screw-cutting lathe completely covered with a coat of rust, and asked to explain, if possible, the cause for the sudden change, and the source of water, when the tool had been in perfect condition ever since its installation, the polished steel work having been bright and apparently beautifully kept only forty-eight hours before. The building was perfectly dry, with no indications of moisture either inside or out, yet the lathe was so thoroughly oxidized that it presented the appearance of iron-work which had been exposed to a dense sea fog. Owing to the suddenness of the change, and to the fact that a number of other smaller tools which had always been in a well polished condition were also badly rusted, the source of water, and the case, seemed surrounded with mystery. It was learned by the writer that a gasoline furnace had been in prolonged use by some plumbers several days prior to the discovery of the rust for the purpose of melting pots of lead for making leaded joints. This furnace had been placed directly upon the floor, 10 or 15 feet from the lathe, with no chimney or other means of ventilation. The water vapor resultant from the combustion of the gas from the gasoline found a most approved condenser in the polished steel of the lathe, the surface of which it immediately converted into rust. As will be shown by the following experiments, water is a definite product of combustion, and should it prove necessary to burn gasoline, wood or charcoal, in the presence of polished steel, it should be protected with a cloth covering, or a coating of oil, and the products of combustion should, in addition, be led to a chimney, or other suitable exit to the atmosphere. Of course in some buildings where there is a good draught of air, the water vapor is less liable to collect, and condense. The writer has had valuable articles, such as large steel plates, badly rusted by leaving them in a badly ventilated room, with the city illuminating gas burning from the common gas fixtures. A couple of experiments on the formation of water by the combustion of gas in the atmosphere may prove of interest to those who have not had opportunity to have observed the synthesis of water in a chemical laboratory. The simplest experiment which any one may perform is to hold a thick, cold metal plate in the flame of a Bunsen burner, or alcohol lamp.



AUTOMATIC HOOP AND BASKET STRIP CUTTING MACHINE.

A coat of moisture forms in an instant, but it is not possible to obtain water in any quantity with this method, as the heat of the flame soon vaporizes the coat of moisture, and leaves the surface of the iron warm, and dry. The flame from a common gas burner will also deposit water, but in addition it will deposit carbon from the hydrocarbon in the city gas, and is consequently less suited to the experiment.

Fig. 1 illustrates an experiment designed to prove the formation of water by the combustion of a simple hydrogen flame in air. The large flask at the left is fitted with two necks as shown, one of which has a funnel tube for supplying dilute sulphuric acid, which falls upon zinc fragments in the bottom. The other neck is provided with a glass tube which siphons down, so to speak, in an upright jar filled with a solution of permanganate of potash for purifying the hydrogen liberated from the sulphuric acid. The second jar contains concentrated sulphuric acid for removing moisture from the gas, and the bent "U" tube fragments of calcium chloride, also for the purpose of removing any traces of moisture. The result of this arrangement is perfectly dry hydrogen gas at the bent outlet tube. Immediately upon pouring the dilute acid upon the zinc fragments, the hydrogen is liberated, and passes through the system. The jet should not be kindled for some few seconds, for fear of an explosion of the mixture of gas and air. A safe plan consists in filling a small test tube with the gas as it issues, and testing that. If it cracks, it indicates a mixture of air and gas. It it burns quietly, it may be used at once to light the jet with. Now, on holding a large, cold bell glass over the flame, the water vapor soon condenses, and falls in drops into a glass provided for the purpose. For a continued production of water, it will be found necessary to keep the bell jar cool from the outside, by cloths wet with ice water.

In order to illustrate the definite formation of water, two glass globes with necks should be employed, as illustrated in Fig. 2. The one at the left is partially filled with cupric oxide, and is attached by means of a short piece of rubber tubing to a similar empty globe. The bulb containing the cupric oxide is now attached to the little burner from the "U" tube by means of a rubber coupling, and the stream of hydrogen allowed to flow through the entire system. After a few moments the bulb containing the cupric oxide is heated by means of a Bunsen burner, or alcohol lamp, lightly at first, then strongly. The oxygen from the cupric oxide is liberated by the heating, and combines with the hydrogen which is passing through. Water is formed by this combination, which collects in the bulb at the right as indicated. In order to prove the definite composition of water by means of this experiment, it is only necessary to weigh the bulb containing the cupric oxide before and after the experiment, in order to ascertain the quantity of oxygen taken up by the hydrogen, and to weigh the second bulb empty and when containing the water resultant from the union. Knowing the weight of water, and the weight of oxygen, it is a most simple matter to calculate the quantity of hydrogen. On these general lines, it was calculated by the writer, using the data available regarding the gasoline furnace, that at least three pints of water had been formed, and evenly "sprinkled" over the polished, unprotected lathe.

NIAGARA FALLS HYDRAULIC POWER PLANT.

In the present number we conclude a series of articles on Niagara, the first of which, on "Niagara as an Industrial Center," appeared in our issue of May 27. On June 17 we illustrated the many handsome bridges which have been thrown across the Niagara gorge in the past fifty years, and on July 22 we gave a lengthy description of the 50,000 horse power electric plant of the Niagara Falls Power Company. In the first-named article it was shown that taking into account all the turbines that are at present in use, big and little, of the total theoretical horse power of 7,500,000 at the falls, only about 50,000 horse power is at present being developed and actually utilized, either as hydraulic or electrical power, for industrial and transportation purposes. This total, however, is constantly being increased, as the various additions which are being made to existing plants are brought into operation; and it will not be many months before the total amount of power developed will have increased by fifty per cent.

So much attention has been directed to the Niagara Falls Power Plant, with its present capacity of 40,000 horse power and actual output of from 20,000 to 30,000 horse power, that the public has not realized the size and rapidly growing importance of the Niagara Falls Hydraulic Power Plant, which has at present a capacity of 13,000 horse power, and has an enlargement under way which will increase its total capacity to 20,000 horse power. The method of developing the hydraulic power differs widely from that which has been employed with the Niagara Falls Power Plant, where, it will be remembered, the water is led in from the river above the falls by a short length of canal to the power house, and delivered through penstocks to a set of turbines which work under a head of 135 feet. The tailrace for the latter consists of a great tunnel with a fall of 50 feet in a length of 7,000 feet, and the water is finally discharged into the lower river at a point below the falls.

In the case of the Niagara Falls Hydraulic Power Plant, the water is taken from the river above the falls by an open canal and led to a point about a mile below the falls, where it passes through penstocks to turbines that are situated within a power house, which is built close to the water's edge at the bottom of the gorge, as shown in the two illustrations on the first page. The advantage of the latter system is that the effective head is considerably increased, the loss of the head in the tunnel being 50 feet and in the canal only 2 feet. By suitably constructing the tailrace, an additional head of several feet is secured below the turbines, with the result that the total effective head of the hydraulic power plant is 210 feet. The total length of the surface canal is 4,400 feet, its present width at the entrance is 250 feet, and in 400 feet the width narrows down to 70 feet. At this width it continues into a basin which is located about 300 feet back from the edge of the gorge above the power house. The basin runs parallel with the edge of the cliff and is about 400 feet long by 70 feet wide. The company owns sufficient right of way to increase the width of the canal to 100 feet, if it desires to do so. For 40 feet of the present width of the canal the channel is 14 feet deep, and for the remaining 30 feet it is 8 feet deep. The work of widening the canal is now in progress.

The power house is a substantial building of stone with a steel truss roof. Water is led down to the power house by means of two penstocks, one of which is 8 feet and the other 11 feet in diameter. The original section of the building was completed in 1896, and an 8-foot penstock serves to convey water to four Leffel turbines, of 2,250 horse power each, which operate eight generators, six of which supply power to the lower works of the Pittsburg Reduction Company, while the other two furnish power for the operation of the Niagara Falls and Lewiston Railway, better known as the "Great Gorge" route, illustrations of which will be found in the SCIENTIFIC AMERICAN of March 28, 1896. The operation of the original installation was so satisfactory that a large addition was immediately commenced, and the building was increased to the size shown in our illustration. It now measures 100 feet by 120 feet. The addition to the plant consists of five wheels of the Jonval-Geyelin type, each of 2,500 horse power. Our illustrations show one of the new wheels in place. These wheels are fed by a new 11-foot penstock, which has a capacity of 12,000 horse power. It leaves the forebay with an elliptical bell mouth which measures about 20 feet by 11 feet, and is carried out horizontally from the cliff, supported on two heavy steel beams for a distance of 60 feet, and then drops vertically nearly 200 feet to the power house. For about fifty feet of its length beneath the power house floor it is 13 feet in diameter, and, after passing beneath two of the wheels, its diameter is reduced to 7 feet, beyond which point it tapers off into a cone 18 inches in diameter, and finally ends in an air-chamber, which is 4 feet in diameter by 15 feet in height. The object of the air-chamber is to cushion the vertical movement of such a great mass of water and prevent injurious shocks to the machinery. The steel used in the construction of the penstock varies from a thickness of $\frac{5}{8}$ of an inch at the top to $1\frac{1}{8}$ inches at the bottom.

Above the horizontal portion of the penstock beneath the floor are carried a series of five 60-inch hydraulic valves which are placed horizontally and serve to conduct the water from the penstock up to the five turbines which are placed immediately above them. These valves, with their supporting girders, are shown in the lower illustration of our first page. The water flows through the valves to the turbines and is admitted by a gate to the guide-wheels, and through them to the runners. From the sides of the turbine the discharge pipes project laterally and then downwardly to connect with draught tubes 22 feet 8 inches in length, the use of which makes it possible to utilize in part the atmospheric pressure, and increase the effective head of the turbines accordingly. The turbine wheels are made of bronze, and they are located in the draught-tube casing, one on each side of the casing proper. The pair weighs 5,095 pounds. They are mounted upon a horizontal shaft and are directly connected to a general electric generator, which supplies current to the new chlorate of potash plant of the National Electrolytic Company, located on the top of the cliff.

A walking-beam, working over the main casing, operates the gate which is connected to the beam by $2\frac{1}{4}$-inch rods extending down through the glands into the casing. Above the walking beam is an air cylinder 36 inches in height, with a diameter of $20\frac{1}{4}$ inches. The turbine is controlled by a Reynolds governor. It should be mentioned that there are thirty-four buckets on the runners with a total area of 140·25 square inches. On the guide-wheel there are twenty buckets with a total area of 149·53 square inches. The General Electric Company's generator is shown in our illustration. It has fourteen poles and runs at 257 revolutions per minute, giving an output of 5,000 amperes at 175 volts. This represents a capacity of 875 kilowatts or about 1,200 horse power. The current is carried to the chlorate of potash works on aluminium cables, the lower part of which is made in bar form and the upper part in the form of well insulated cables. The dynamo for the Buffalo and Niagara Falls Electric Light and Power Company is of 700 kilowatts output capacity at 2,200 volts pressure.

The completion of the five Jonval-Geyelin turbines will raise the total h e power at this station to 20,000, but it is intended to build another 11-foot penstock and increase the total horse power of the plant to 30,000, which will be the maximum that can be developed from the present upper basin. Ultimately, however, it is intended to extend the basin along the cliff beyond the present factories of the small users of the company's water power, and carry down other penstocks to a new power house at the edge of the river. The company has sufficient room to install a total of 100,000 horse power, which is well within their grant of 125,000 horse power. The present capacity of the canal is about 40,000 horse power, but the company has a force of dredges which are continually at work enlarging and deepening it.

Visitors to Niagara will have noticed the cascades of water which fall from the side of the cliff in varying quantities in the immediate neighborhood of the company's power house. These streams are the tailraces of the various smaller factories which are built at the edge of the cliff, and take water from the company's basin behind them. The turbines operate under heads of from 60 to 100 feet In some cases they are sunk in wheel-pits and discharge through tunnels, while in others a cutting is made through the face of the cliff. The total hydraulic power thus developed is about 7,500.

This brings us to the close of a subject which we have treated at considerable length because we believe that there is a great demand for complete information upon a matter of such importance as the utilization of the energy of the falls.

Isolated statements of work done in this or that establishment at Niagara Falls have been published from time to time, but these are not sufficient to give such a comprehensive view of the subject as we have endeavored to set forth in these articles. While the work of developing this great source of hydraulic power has not gone forward with the rapidity which was popularly expected, it must at least be admitted that what has been done has been carried out on conservative lines and with such a measure of success as promises well for the future.

Trouble with a Cycle Path.

A cycle path in the upper part of New York State was opened to the public, and soon after complaints began to pour in from riders whose tires had been punctured on the new track. There was no reason why a perfect riding path should not be obtained. An inspection of the first two hundred yards of the path, where most of the punctures were caused, failed to reveal the cause of the difficulty. No amount of sweeping sufficed to clear away the obstruction. Finally, however, it was learned that the cinders for the first quarter of a mile of the path had been secured at a shoe factory and that there were tacks in the cinders. According to The American Exporter, the head of the factory, when learning the facts, offered to share with the county the expense of laying fresh cinders. Before this was done, however, one of the riders had a framework of wood made and fitted with rollers and a handle so that it could be operated like a carpet-sweeper, and then placed six large and powerful magnets in it. They were so arranged that they would almost scrape the ground when the machine was operated. This was run back and forth over the ground until the last piece of metal was removed from the path.

A Gigantic Megaphone.

An enormous megaphone has been erected at Faulkner's Island, Conn., on the government lighthouse reservation, for testing a new system of fog signals. The megaphone is 17 feet long and 7 feet in diameter at the mouth. Attached to it is a $1\frac{1}{2}$-inch steam siren. The whole contrivance is mounted on a circular platform 28 feet in diameter, so that it can be revolved to any point of the compass. Different signals may be made for each point of the compass. The object of the invention is to throw the sound waves in a certain direction to the exclusion of any other direction, so that any vessel approaching the signaling station in a fog shall hear only the sound which is given when the megaphone is pointed directly at it. That is to say, if the signal means north, the fog signal must be due north of the vessel, or those on the latter could not hear that particular signal. The instrument has been tested and it is found that the sound was heard 10 miles away when the observer was standing in a line with the axis of the megaphone, but nothing could be heard of the sounds sent to other points of the compass when at a distance of a mile or more from the instrument.

Science Notes.

On the basis of results of previous exhibitions at Paris, it is assumed that 52,588,280 people will pass through the turnstiles, and it is possible that the total number may reach 60,000,000.

A series of lectures will be given in New York city under the auspices of Arctic Club of the America by those who have actually made explorations in the Far North. Among those who will lecture will be Prof. W. H. Brewer, H. L. Bridgman, Walter Wellman, and Dr. F. A. Cook. The proceeds will be given to the furthering of Polar research.

The death of Mr. Hamilton Y. Castner, the chemist, was announced a short time ago. He invented a process for producing sodium which enabled aluminium to be produced at a comparatively low price. He also invented a process for the electrolytical production of alkali and bleaching powder from common salt, and a process for making cheaply cyanide of potassium.

In an official report of a government inspector of factories for Coburg Gotha some interesting figures are given as to the labor of children under fourteen years who make buttons, toys, etc., at their homes. They work from 4¼ to 6 hours a day, and earn in button-making from ⅛ of a cent to 7 cents; in doll-making from 2⅛ to 18½ cents; from work on toys, 1⅜ to 14 cents.

A French journal tells a story about a dog which belonged to an English dentist. The dog was scarcely able to support life owing to the loss of its teeth. The dentist made an artificial set, including four canine teeth and four molars mounted on a plate in the ordinary way. The dog now eats meat and even gnaws bones without difficulty and he has gained considerably in weight.

It is proposed owing to the number of accidents which occur each year that the Maine legislature pass a law prohibiting the wearing by hunters of buff-colored clothes which may be mistaken at a distance for a deer. Ordinary hunting clothes are the worst possible thing for a man to wear in the northern woods. Accidents have been most frequent and several hunters are killed annually, often being shot by their friends who think they see a deer.

A German doctor has devised a plan for massaging rheumatic joints. He takes the patient's hand and puts it in a deep glass which is two-thirds full of quicksilver. The mercury exerts an equal pressure on every portion of the fingers and the pressure increases rapidly as the fingers sink further into it. The hand is alternately plunged and raised about twenty or thirty times at each treatment, and after a second visit there is a marked diminution of the swelling.

Great Salt Lake is receding on account of the excessive drain made upon it by irrigation enterprises. This lake is not fed by underground springs, but by the Jordan and other rivers, and when the waters of these streams is intercepted for irrigation purposes the water supply of the Salt Lake is, of course, diminished so that the evaporation which is constantly going on is not made up by a new supply. In time it looks as if the lake will be only a bed of dry salt.

Baled shavings are a standard article of commerce and are largely used for stable bedding and padding in straw boxes as it is finer and there is less waste. It is also more sanitary, being more absorbent, and in the case of pine, cedar, fir or spruce shavings, pitch and turpentine in them neutralize the manure and do away with the usual stable odors. Owing to the fineness of the shavings, an uneasy horse cannot paw the bedding out from under him as he does when straw is used. Feed dealers in cities now sell quantities of baled shavings for this purpose. They are also used for packing.

A remarkable collection of films for moving picture machinery are now being developed at the laboratory of Mr. Edison in West Orange. The pictures are of the Klondike and are intended for the exhibit Mr. Edison is to make at the Paris Exposition. The entire series will show actual life in the Klondike as it has never before been shown. The positive pictures on the film are nine times the size of the ordinary ones, and in order to use the larger film it was necessary to reduce the speed of the camera from forty-five to twenty pictures a second. The reduction of speed has, of course, resulted in a gain in clearness.

A great German airship is being constructed in a dockyard. It is being built on a floating raft, and at present it resembles the skeleton of a huge vessel. It was built of such delicate material as to suggest an enormous bird-cage. It is made entirely of aluminium, and the outer skin will be stretched on this framework. Inside a number of large balloons will be placed. A gallery and cars all made of aluminium will be placed underneath; engines are provided to drive the airship. The total lifting capacity of the airship will be about 10 tons, which is sufficient for it to carry enough stores and ballast to permit of its remaining in the air for some days; $350,000 has been expended upon this experiment. **For full details see the current SUPPLEMENT.**

Engineering Notes.

Owing to the high premiums demanded of railroad employes by insurance companies, the Chicago & Alton Railroad Company have inaugurated a new plan. The company proposes to defray half the premium of each policy, the men to pay the other half. This is certainly very liberal on behalf of the railway corporation.

The water supply of Havana is collected from springs at the base of a range of coral hills, and carried through a masonry aqueduct 33,000 feet long to a reservoir holding 21,000,000 gallons. The consumption and waste of water in the city is estimated at 173 gallons per capita daily. The city is supplied by gravity from the reservoir.

A company has been formed for the purpose of bringing sea water to London from an intake at Lancing in Sussex, from whence the water is to be pumped to a level of nearly 500 feet at the top of Steyning Hill. It will then flow by gravitation through a main to Battersea and thence across the Thames to Cromwell Road, South Kensington, whence branches are to be laid for service in other districts.

Large sums of money will be spent on river and harbor work at New York, and Gen. Wilson, Chief of Engineers, estimates that $200,000 will be required for removing rock in the East River and Hell Gate; $500,000 for widening and deepening the Harlem River; $100,000 for the maintenance of the present channels in New York Harbor, and $332,000 for increasing the depth of the new Bay Ridge channel from 26 to 40 feet.

An express train will be run between Berlin and Bucharest with a bi-weekly direct service to Kustendjie, whence the Roumanian steamers ply to Constantinople. The new service will reduce the duration of the journey from Berlin to Bucharest to thirty-three instead of forty-one hours. The Orient Express via Belgrade and Sofia has hitherto taken sixty-four hours. By the improved service it is estimated it will occupy only forty-eight hours.

At White Haven, Pa., there is an auxiliary fire system. The borough owns a fire engine, but the streets are so steep that delay follows any attempt to get it to the fire. It is therefore utilized as a stationary engine. In the center of the town there is a small reservoir holding about 1,800 gallons of water, and it is connected with the city mains. From this engine house radiate three separate lines of 4-inch pipes, covering the area of the town, with hydrants at the intersection of the streets. In case of a fire the engine is connected with the pipe system, the suction pipe is dropped into the reservoir, and water is allowed to run into the reservoir from the city mains. The system has proved very effective.

A curious accident took place at Brookfield, Indiana. A local freight train was backed into a siding to allow a fast freight train to pass. The switch was left open, however, and the fast freight traveling at the rate of thirty miles an hour dashed into it. The crews of both trains jumped. The impact of the collision was so severe as to drive the tender of the stationary train off its trucks and telescoping a cattle car which was loaded with coal, it rested half on the top of the third car. On the fast freight a car loaded with hogs was telescoped by one loaded with shelled corn and the animals not killed in the collision were smothered by the corn. It is said that the locomotives are so interlocked that dynamite will be required to separate them.

In the County of Down, Ireland, is a steel-plate road known as the Benbrook and Newry Railway. It is 3 miles long and has a rise of 180 feet. It has been in operation for sixteen years. It is an ordinary railway of 3 feet gage. All the trains are both freight and passenger. The passenger line is built of ordinary steel rails, outside of and adjoining which is a lower line of steel rails. The wagons are without flanges on the wheels and run on the lower outside rails. The inner rails for the cars are high enough above the outer rail to act as a guide to the wagons, keeping them on the track. The wagons are brought to the train over regular streets and roads by horses. There is no delay in hitching them to the train. The entire cost of the road was slightly less than $78,000.

Work has begun on the alterations which are to be made in the interior of the Grand Central Station, at New York. This work involves the building of a huge waiting-room at the Forty-second Street end of the building. This will be utilized by all of the roads running into the station and will prevent the confusion which now exists by having three separate waiting-rooms. Seventy-six feet of the train-shed will be required in addition to the present waiting-room of the New York, New Haven & Hartford Railroad. A subway which will pass underneath the tracks will first be built. This will be used for the handling of baggage. Lifts will be provided at every platform to raise and lower the baggage. The work has been delayed for some time owing to the difficulty in getting a sufficient amount of steel. It is thought that eight months will be consumed in making the changes and the cost of the work is estimated at $500,000.

Electrical Notes.

During the recent yacht races, a visitor to them on board the "Ponce" sent a wireless telegram to engage a room at the Hotel Netherland.

The Compagnie Générale de Traction, which has 60 miles of railway track in Paris, will use the Diatto electrical traction system on all its lines.

A new type of electric railway car is being used in Brussels the object of which is to reduce air resistance. The front of the car is triangular in shape, the controller and motorman being stationed in the angle. It has been found that the new car is very efficient.

The director of the Meteorological Observatory on Mt. Blanc has been considering the advisability of installing the Marconi wireless telegraphy system upon the mountain. The ordinary system of telegraphy is used normally, but the great snow-drifts have played havoc with the telegraph wires. It is believed that the wireless system of telegraphy would prove not only valuable from a scientific point of view, but would also increase the safety of travelers upon the mountain.

Granite is not usually considered to be an insulator, but one of the electrical journals reports that insulators are made as follows: Maine granite is crushed and molded into form and fused at 3,000° F. It resists all but hydrofluoric acid, and does not crush at a lower pressure than 14,560 pounds per square inch, and gives a tensile strength of 480 pounds per square inch; 56,600 volts were required to pierce one-quarter of an inch of this material in the shape of cup insulators.

The Santa Ana River, which comes out of the San Bernardino Mountains, is now used to transmit power to Los Angeles, some 82 miles distant. Nine thousand horse power is consumed in propelling machinery, moving street cars, and in heating and illuminating the buildings in Los Angeles, besides furnishing power for several villages around. After being used to generate power, the mountain stream is gathered into a conduit and led down the mountain side to irrigate the orchards and groves in San Bernardino Valley.

The Atchison, Topeka and Santa Fé Railway will be lighted by electricity generated from the car axles, and the locomotive headlights will be supplied from the same source. Each car will have a separate plant consisting of a dynamo and storage batteries, and the full train will have electrical equipment equal to over 4,900 candle power exclusive of the locomotive headlight. These trains will be the longest solid axle-light ones in the world, and will be the first to carry so large a lighting service derived exclusively from the car axles.

A school for trolley-car motormen is maintained by the Brooklyn Rapid Transit Company. Cars are run on the tracks about Fort Hamilton and Coney Island. Instead of having simply a room to practice in with controller and brake equipments, the men in Brooklyn actually operate the cars under competent instructors. School cars of various grades are used. In one car the use of the controller is taught, and in the next the use of the brake, and on the third the car as a whole is handled. The entire course takes from a day to a week. This is a rather better system than putting green motormen on cars which are actually run through the crowded streets of the city.

Hans S. Beattie, of the Metropolitan Street Railway Company, who was formerly Street Cleaning Commissioner of New York, considers that the street railway system might be used to help solve the garbage and ashes problem in New York, and to aid in the expeditious removal of snow and ice. The withdrawal of 800 horses and carts from the most congested part of New York during the busy hours of the day would, in itself, be a benefit. If the street car lines should be utilized, many of the dumps which now occupy valuable piers could be done away with, and the rental value of these dumping stations if they should be released to the commerce of a port would bring in a substantial financial return to the city.

A gravity balance, invented by Prof. Pollock and Prof. Threlfall, was described by the latter at a recent meeting of the British Association. In brief, the apparatus consists of a quartz fiber fixed at its ends and stretched horizontally; the fiber carries at its center a light wire at right angles to its length, and loaded. The fiber is twisted until the wire is only just in stable equilibrium, under which circumstances a very small change in the value of gravity will cause it to tilt through a measurable angle. The instrument is so delicate that it can detect changes in gravity which amount to less than two-millionths of the whole acceleration of gravity. The instrument is portable, and has been used in coast survey work in Australia, during which time it traveled 6,000 miles, and it has been brought to England, and its sensitiveness is still unimpaired. The short pendulums used in the United States Coast Survey gave results accurate to four parts in a million, this being, however, the mean observations with three such pendulums, and not the record of a single instrument. It will be remembered that Prof. Vernon Boys has used quartz fiber for many years for delicate scientific instruments.

OUR NEW FLEET OF TORPEDO-BOAT DESTROYERS.

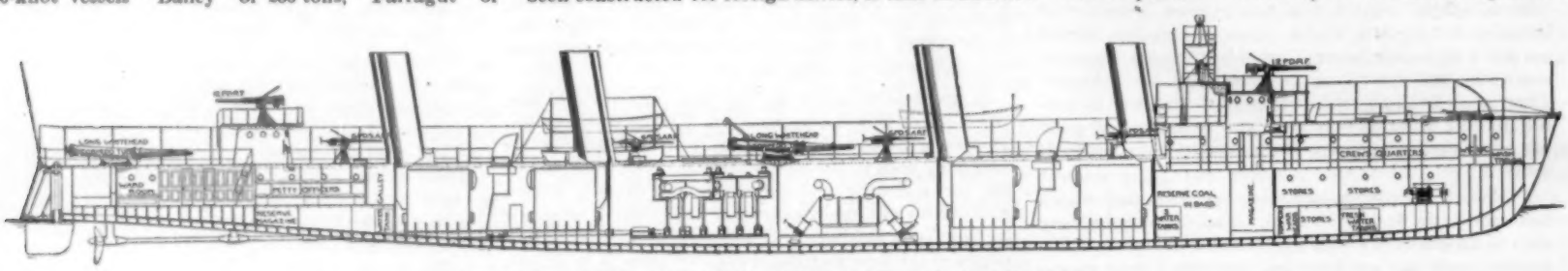
It is only of recent years that the United States government has undertaken the construction of torpedo-boat destroyers on an extensive scale; but thanks to the acts of Congress in the years 1896, 1897, and 1898, we have now either built or building no less than thirty-seven torpedo boats and sixteen destroyers, a total of fifty-three of these formidable little craft. At present we have no torpedo-boat destroyers proper in commission in our navy, the nearest approach to this type being such boats as the "Porter" and the "Dupont," of 165 tons displacement and between 28 and 29 knots speed. There are other vessels much larger than these nearing completion, if not already commissioned, which while they would undoubtedly be capable of accompanying a fleet to sea and are fully as large as some of the torpedo-boat destroyers in other navies, are not listed as such in the official tables of the Bureau of Construction and Repair. Such are the 30-knot vessels "Bailey" of 235 tons, "Farragut" of 273 tons, "Goldsborough" of 247·5 tons, and the "Stringham," a large boat of 340 tons, which is expected to develop 30 knots with a total horse power of 7,200.

The accompanying illustrations will make our readers familiar with the appearance and internal construction of the sixteen torpedo-boat destroyers of the "Bainbridge" class, which were authorized in May in the year of 1898. The contracts for these vessels were let in the fall of the same year and the contract date of completion lies in the early months of the year 1900. All of them conform closely to the accompanying diagram in the general arrangement of the engines, boilers, armament, etc. There are minor differences which are indicated in the subjoined table.

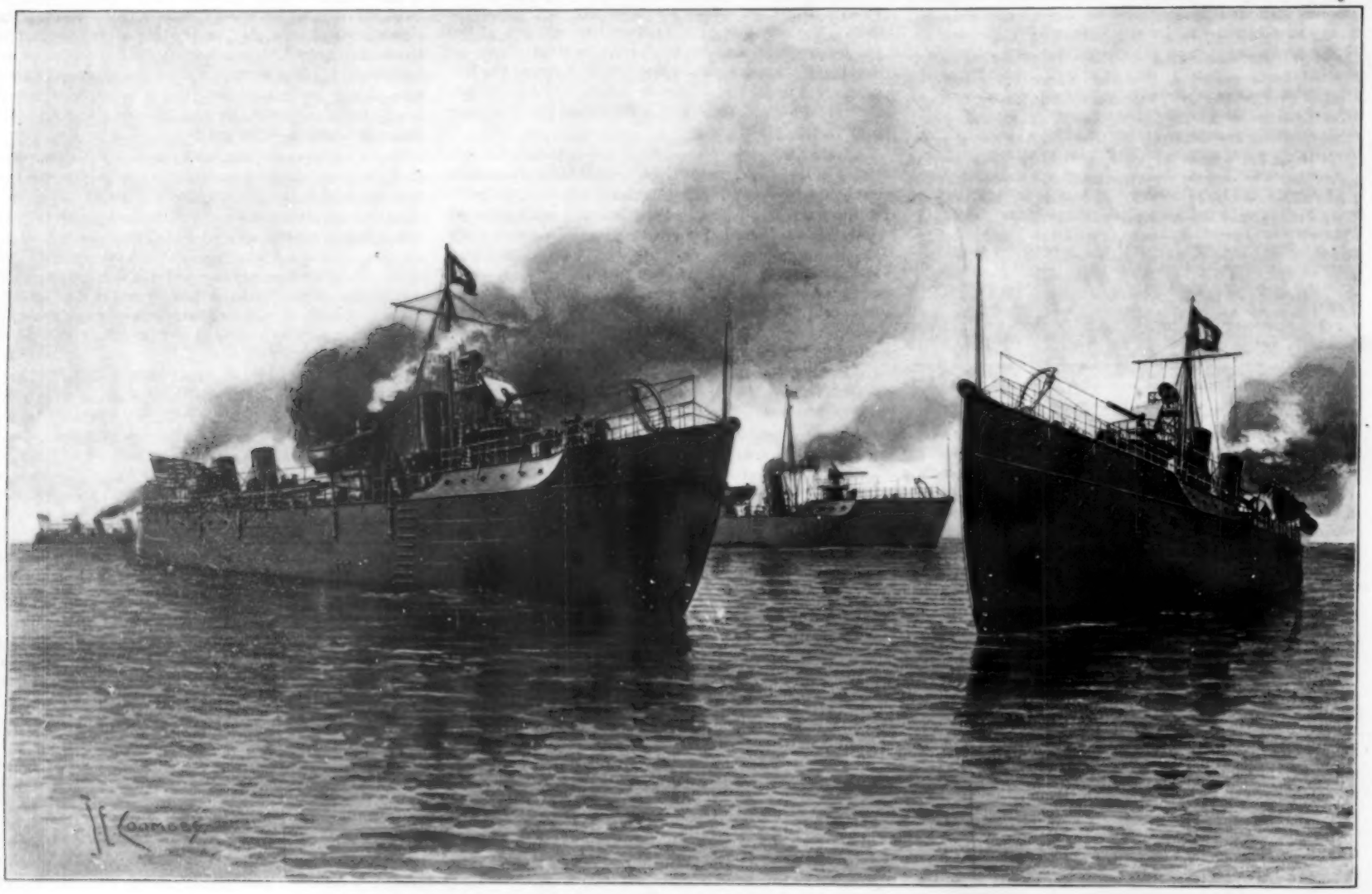
Nine of the destroyers are of 420 tons displacement and will develop speeds of 28 and 29 knots with 8,000 indicated horse power. They will be known as the "Bainbridge," "Barry," "Chauncey," "Dale," "Decatur," "Paul Jones," "Perry," "Preble," and "Stewart," being named after heroes whose names are associated with the most brilliant episodes of our naval history. It should be noted that the three last named of these vessels, which are being built by the Union Iron Works, of San Francisco, are guaranteed to give a speed of 29 knots with 7,000 instead of 8,000 indicated horse power. Each destroyer will carry on the main deck two torpedo tubes for the discharge of the 18-inch Whitehead torpedo. The armament will consist of two 12-pounder rapid-fire guns carried, one forward and one aft, above the conning towers and protected by shields. There will also be five 6-pounders carried in broadside on the main deck. These vessels will have a length of 245 feet, a beam of 23 feet 7½ inches, and a draught of 6 feet 6 inches. They will be capable of carrying 139 tons of coal closely stowed in their bunkers, and the complement will consist of four officers and sixty men. One excellent feature, which will give them considerable advantage over some of the latest boats that have been constructed for foreign navies, is that in addition to their relatively large size they are provided with a long forecastle deck which gives them an extreme freeboard forward of 14 feet, the freeboard amidships being about 9 feet. This will considerably improve their speed in steaming to windward in heavy weather. Three of these vessels are being constructed by Neafie & Levy, Philadelphia; two by William R. Trigg & Company, Richmond, Va.; three, as mentioned, by the Union Iron Works, of San Francisco; and one by the Gas Engine and Power Company, Morris Heights, N. Y.

The "Hopkins" and the "Hull," which are being built by the Harlan & Hollingsworth Company, Wilmington, Del., are somewhat smaller vessels. They have about the same length, a foot more beam, and 6 inches less draught with a displacement of 408 tons. They are to achieve 29 knots with 7,200 indicated horse power, and the bunker capacity will be 150 tons, the armament and the complement of officers and crew being the same as for the "Bainbridge." The "Lawrence" and the "Macdonough," which are being built by the Fore River Engine Company, Weymouth, Mass., are the smallest vessels of the fleet. They will be of 400 tons displacement and they are to achieve a speed of 30 knots with 8,400 indicated horse power. The coal capacity will be less, namely, 115 tons; particulars of the armament and the complement will be the same as for the other vessels. The largest of the fleet will be the "Truxton," "Whipple," and "Worden," building by the Maryland Steel Company, at Sparrows Point, Md. They will be 248 feet in length, 23 feet 3 inches beam, and on a draught of 6 feet they will have a displacement of 433 tons. They will have the large bunker capacity of 232 tons—a very valuable feature—and they are to make a speed of 30 knots with a development of 8,300 horse power.

These destroyers when completed cannot fail to produce a favorable impression. Their size, roominess, coal capacity, and powerful armament, and above all their good sea-going qualities, and high speed, will place them in the very front rank of this type of vessel.



Longitudinal Section, "Bainbridge" Type of Torpedo-boat Destroyer.



THE NEW FLEET OF UNITED STATES TORPEDO-BOAT DESTROYERS.

Name of Class, "Bainbridge." **Displacement,** 420 tons. **Speed,** 29 knots. **Armament,** two 3-inch 12-pounders, five 6-pounders. **Torpedo Tubes,** two 18-inch Whiteheads. **Coal,** 139 tons. **Complement,** 64. **Date,** 1899.

Name.	Number of Vessels.	Length.	Beam.	Draught.	Displacement, Tons.	Horse Power.	Speed, Knots.	Bunker Capacity.	Torpedo Tubes.	Armament.
		Ft. In.	Ft. In.	Ft. In.						
Bainbridge	9	245	23 7½	6 6	420	8,000*	29	139	2-18 in.	2-12 pdr., 5-6 pdr.
Hopkins	2	244	24 6	6 0	408	7,200	29	150	"	2-12 pdr., 5-6 pdr.
Lawrence	2	242 3	23 3	6 3½	400	8,400	30	115	"	2-12 pdr., 5-6 pdr.
Worden	3	248	23 3	6 0	433	8,300	30	232	"	2-12 pdr., 5-6 pdr.

* The "Paul Jones," "Perry," and "Preble" are to indicate 7,000 horse power.

In the year 1898 no less than $425,000,000 was invested in Great Britain alone in electrical enterprises.

ACETYLENE MOTOR WAGONS AND CARRIAGES.

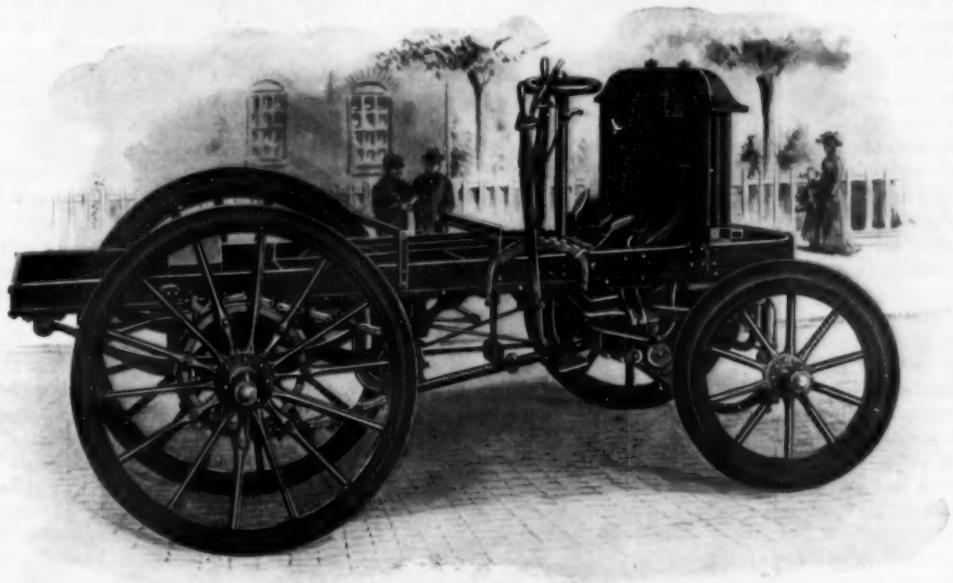
Our engravings give an idea of the running gear of a standard truck for delivery wagons, etc., and of a victoria, both being operated by acetylene gas and made by the Auto-Acetylene Company, of 15 Park Row, New York city.

The standard truck for delivery wagons and other heavy vehicles, shown in our second engraving, weighs 1,000 pounds as it stands. The motor consists of a duplex engine having four cylinders and two exploding chambers. It is capable of running without a flywheel, and the normal speed of the engine is 1,000 revolutions per minute which, when connected with the driving mechanism, propels the vehicle at a rate of 12 miles an hour, which is sufficient for all business purposes. The intermediate gearing permits the reduction of the speed to 1¾ miles per hour. The engine itself is not reversible, but back-gearing is provided and can be thrown into operation by a foot shift and the wagon backed at a speed of 1¾ miles per hour. The speed forward can be graduated from the minimum to the maximum with the greatest ease. No water jacket is necessary with this motor, nor is any other means for cooling the engine necessary. With a special apparatus arranged for speed on a test of nine hours, the motor ran at the rate of 35 miles per hour with none of the parts of the engine heating abnormally. A vehicle similar to the one represented in the engraving has traveled 6,390 miles with but one accident or stoppage due to any defective part of the machinery. The engine employed is designed specially for the use of acetylene gas; 1,500 cubic inches of carbide will drive the truck, which is of 10 horse power, 70 miles at a speed of 12 miles per hour. There is a valve provided which permits of changing from acetylene gas to gasoline and from gasoline to kerosene oil, so that while the engine is operated most economically and satisfactorily with acetylene, at the same time other fuels can be used in an emergency, if supplies of carbide are not readily obtained.

The same company has recently made three miner's prospecting wagons which possess many features of interest. The wagon is constructed so as to possess strength, and all machinery is carefully shielded, so that underbrush, etc., will not interfere in any way with its operation. The idea in these prospecting wagons is to provide a miniature mining camp complete which can be transported at the rate of 2½ to 4 miles an hour. A small ore crusher is mounted upon the truck, so that it can be connected directly with the motor, and an assay furnace is also provided to test the gold-bearing ore as it may be found. The seat in front can be turned down to provide a bunk for two persons, and while one man drives the wagon his companion can busy himself making assays of the findings. Ample food supplies can be carried, and with one of these wagons a trip of two or three weeks can be made by prospectors.

Our other engraving represents a comfortable victoria for two or three people and has one auxiliary seat which can be used if desired. The engine is mounted on the forward truck. The total weight of the carriage is only 750 pounds. The explosion of the hydrocarbon mixture is between the pistons moving in opposite directions. The vibration is neutralized, and no shock is imparted to the vehicle. At all speeds it is practically noiseless, making no more sound than a well-constructed electric vehicle. The pleasure carriages are provided with duplex speeds that give all the speeds that can be obtained with a truck, as we have already seen, and this can be multiplied by two, three, or four, which means that a vehicle can be operated from 1¾ miles to 48 miles per hour. As the carriage is provided with an 8 horse power motor, this seemingly phenomenal speed will be understood. The motor operates directly in proportion to the power required. The cycle calculation is so determined that the fuel consumed is in direct ratio to the power exerted. What has already been said concerning the carbide and gasoline for the truck applies equally well to the victoria. The steering is done by means of a wheel or a lever. Either device may be used at will, the wheel being the best for long journeys and the lever for short ones. The steering gear is cushioned upon a telescoping hub. In the carriage shown in the engraving the wheels are of bicycle construction, with wire spokes, steel rim, and rubber tires, but in future carriages with wooden wheels with solid tires will be substituted, for most of the trouble with motor carriages comes from the pneumatic tire, and sooner or later motor carriage manufacturers will come to this view of the matter.

ACETYLENE GAS DRIVEN VICTORIA.



RUNNING GEAR OF ACETYLENE GAS DRIVEN TRUCK

Some Far-Reaching Experiments in Agriculture.

BY DR. EUGENE MURRAY-AARON.

By act of Congress there was appropriated for the use of the Department of Agriculture, during the fiscal year 1899, $20,000 for the collection, purchase, propagation, and distribution of rare and valuable seeds, bulbs, trees, shrubs, vines, cuttings, and plants from foreign lands, with the view to their acclimatization and introduction into this country. To further this work Secretary Wilson has founded a Section of Seed and Plant Introduction, under the direct care of the Division of Botany, and for this section several "agricultural explorers" have been sent to, or are now in, various foreign countries. It is not so much in the field of the domestication of wild or little known plant life that the secretary has wisely determined to expend the fund at his disposal as in that of the introduction into our land of useful plants already elsewhere domesticated and thoroughly proved to be of great agricultural value. One of the explorers sent out is Mr. W. T. Swingle, who, after a most painstaking and successful trip in the countries bordering both shores of the Mediterranean, has returned laden with material and data of the greatest possible value. From a preliminary report made by him many of the following facts are taken.

FINER TABLE GRAPES.—Notwithstanding the great progress made in this country in the improvement of the native grapes, we yet have nothing comparable in flavor or general market value to the fancy European stock derived from varieties of the species Vitis vinifera. Being less hardy than our native species, these foreign varieties have not so well withstood the attacks of the dreaded phylloxera and other enemies to the vine. The French viticulturists long since discovered that a remedy lay in grafting the European vine on selected American stocks, which are almost proof against such attacks. In this way the resisting qualities of the stock are combined with the high quality of the graft, and it has been discovered that the combination is also more prolific than were the European varieties before the advent of phylloxera.

Mr. Swingle has secured upward of 2,000 plants of 119 of the best varieties, all grafted on specially selected American stock. These are to be thoroughly tested in chosen localities in North Carolina, Florida, Alabama, and Kansas, under the direction of the Division of Pomology. Careful observations will be made, so that these varieties may be eventually distributed to the regions best adapted for them, and it is hoped, with confidence, that they can be established in many parts of the South, and that table grape culture can be greatly extended by the culture of these superior European sorts.

General interest will be felt in the South and Southwest in the methods of corinth (commonly called "currant") culture in Greece and Turkey, and the importation of the best sorts of this vine, which it is hoped to make next winter. At present we import of wines, corinths, raisins and fresh grapes, an aggregate of over $8,350,000 a year. No inconsiderable part of this great amount is that which goes to pay for corinths and seedless raisins. It is agreed, and with reason, that not only ought we to be able to produce all of these commodities needed for our home consumption, but we should be able, in time, to add them to our articles of export.

Certain new hybrid varieties, crossed between the delicate high-grade European and the hardy American grapes, the so-called "Franco-American" varieties, have also been obtained, and much is hoped from them, since the resistance of the American parent is to a certain extent combined with the fine quality of the European parent in their offspring.

EVER-BEARING STRAWBERRIES.—Of great interest to the suburbanite and the amateur fruit culturist, although not likely to prove attractive to truckers and market gardeners, is a large, ever-bearing strawberry, much esteemed and very successful in France. The plants of this variety produce fruit for some months each year, and a small patch will yield all the season. In this connection it is interesting to point out that in several portions of the high mountains of the West Indies there grows a variety of wild strawberry which may be picked from the same plants for at least six months, if not longer. These I have found in high pockets or arroyas on the north side of the "Blue Range," in Jamaica, and La Selle Range, in Hayti, and it is more than likely that they will be found in the higher ridges north of Santiago, Cuba. They appeared very prolific for the wild sort, and of a very unusual and delicious flavor.

FIGS AND THEIR CAPRIFICATION.—During the pursuit of his investigations, Mr. Swingle obtained large numbers of the insect, Blastophaga, which is necessary for the fertilization and the production of the richest flavors in the fig. The "caprifig" is the fruit of the male form or tree of the fig species, of which the ordinary fig tree known to commerce and our hothouses is the female form. The caprifig tree does not bear edible fruit, but a small, tough, knurly fruit, filled with the galls of the Blastophaga, from which these little, black, wasp-like insects emerge in due course of their transformation. While forcing themselves out of the male fruit, these insects become thoroughly coated with pollen, which in many cases at that season (July) is carried by them into the female flowers of the fig, which thus become fertilized and ripen good seeds. This seed perfection is valuable to the fig growers in two ways, by preventing the miniature fruit from aborting and falling off, and by reason of the rich, nutty flavor which the fig gets only from the perfected seed. To insure this caprification, the growers suspend bunches of the caprifigs in the female trees at the proper time of the year, and thus aid in the act of fertilization. While there are certain varieties of figs not requiring caprification, the best sorts for drying can only thus be obtained. The only product comparable to the finer imported caprified Smyrnas are a few pounds produced in California every year by the laborious process of hand pollination.

The California State Board of Horticulture was promised, in 1897, by Secretary Wilson, that the capri-

fig insect should be introduced and supplied to them during the present fiscal year. Dr. Howard, entomologist of the department, visited the fig-raising districts of California, in 1898, with reference to the insect problems involved, and Mr. Swingle soon after fortunately originated a new method of shipment, which has made it possible to send the Blastophaga as far as California and assure their arrival alive. This was by wrapping the winter or slow-developing form in tinfoil and sending by letter post. They have now been sent from Italy and from the mountains of Algeria, and, having begun to breed in California, it is hoped they will successfully hibernate there and become regular and useful residents. Small orchards of the caprifig (male) tree will, however, be planted, so that, should a cold snap kill the insect in any given locality, it will be possible to recoup the loss from our own insect farms rather than face the delay and trouble of further introduction by mail. As most of the parasitical hymenoptera are, however, much more adaptable to climatic conditions than are the species of the fig, it is safe to prophesy that Blastophaga will ultimately adjust itself to any region where fig culture will succeed. Now, in California, Arizona, and like regions, where a mild winter is combined with a dry August and September, we may look for abundant success in the fig-drying industry, one which now costs us many thousands of dollars annually on the import side of our national ledger.

THE TRUE ARTICHOKE.—This name is here commonly applied to a tuber resembling the potato, which is now grown in some localities quite extensively for stock feeding and alcohol distillation, but is of little value for human food. This is the "Jerusalem artichoke." The unopened heads of a thistle-like plant are, however, the real artichoke. The latter are a delicacy greatly prized in certain parts of Europe and produced in enormous quantities in France and Italy. The plant, a perennial, does not come true from seed, but is propagated, like the pineapple and many other plants, from suckers.

As the true artichoke is much prized in New Orleans, Savannah, Philadelphia, and New York, having for some time been grown for local use in the former city, it is believed that the general introduction of the plant will be appreciated by the people throughout the country, and a sufficient number of suckers have been imported by the department to early insure their indefinite multiplication. The cultivation of the artichoke should prove to be a profitable venture among our Southern truckers, especially as it is adapted to furnishing a canned delicacy.

A JAPANESE DELICACY.—The Stachys is a vegetable imported into France from Japan and known in its adopted country as the Crosne, from the location of the estate of M. Pailleux, of Crosne, a gentleman who devotes his time and grounds to the culture of new and strange vegetables from all quarters of the globe. This vegetable is perfectly hardy, grows in all soils, and yields up to five tons per acre of white tubers two to four inches long, the size of a finger, looking like a crowded string of beads. It is considered one of the most delicious vegetables known to man.

PISTACHE CULTURE.—The culture of the pistache nut is likely to prove of very considerable value in California, Arizona, and New Mexico. With the exception of the home-consumed product of a few isolated trees, the entire quantity now used in this country is imported and its use is limited almost exclusively to ice cream and confection flavoring.

Along the Mediterranean, where the choicest walnuts and almonds are raised, the pistache is considered the very best of all nuts for table use. It is very nutritious and fattening, and of a delicious flavor of its own, and should soon come to be a leading article of its kind in our markets. Mr. Swingle perfected arrangements by which some choice grafts will reach this country next spring.

DATE PALM CULTIVATION.—While able to withstand considerable frost in winter, this palm must have a very dry and exceedingly hot climate at the time of the ripening of the dates. The sandiest and, generally speaking, the poorest soils produce the best dates; while it will yield in any soil, it takes most kindly to otherwise almost worthless land, even that which is white with alkali suiting it. Still, an abundance of water is at certain periods of its maturing quite necessary.

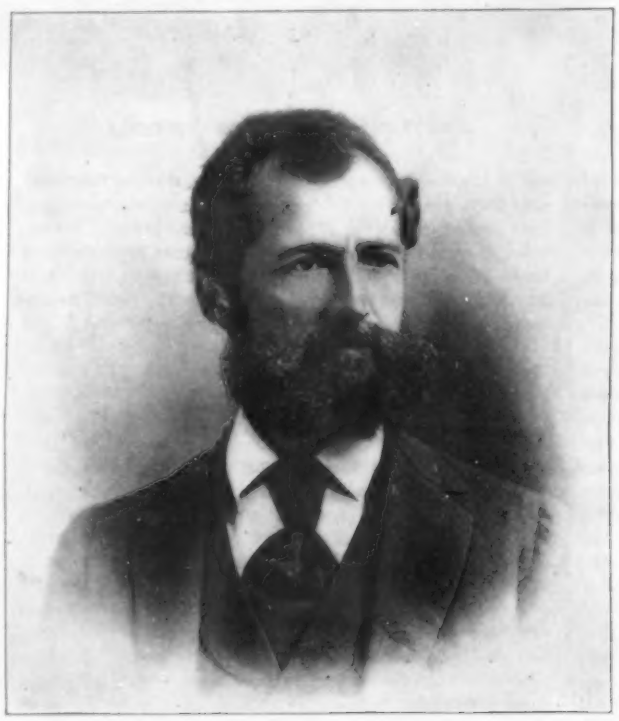
Mr. Swingle has studied date culture in Algeria, and shipments of the suckers of the true Degletnoor date and other choice varieties from the Sahara Desert have already been sent to the Arizona Experiment Station. There investigations show that the best dates will succeed in Arizona. This is pleasing to Secretary Wilson, who has had success in this profitable culture for otherwise neglectable lands much at heart.

THE ST. JOHN'S BREAD.—A most promising forage plant for growth in the warm parts of this country is the carob, or St. John's Bread, a variety of the Leguminosæ. The carob, through the medium of vast quantities of bacteria, which are parasites upon it, yet not especially harmful, derives its nourishment quite largely from the air, and is, therefore, a productive bearer in poor soil. A full-grown tree will average half a ton of pods, and as much as one and a half tons has been yielded in one season by a single tree in Spain. The pods, which are often eaten by man, make excellent food for horses, cattle and sheep, being very nourishing, containing, as they do, over 40 per cent of sugar, over 8 per cent of protein, and less than 25 per cent of indigestible matter. Enormous quantities of carobs are produced in all the countries surrounding the Mediterranean, where they are a much prized product, none the less because of the fact that they do best on arid soil, where nothing else will, preferring a rocky or calcareous soil near the sea. Although doing well in poor soil and without water, their cold resistance is slight, and they are confined to regions in which the orange will thrive.

Some young grafted trees have been secured by Mr. Swingle from the best sorts in Algeria, and varieties from other lands have been arranged for. There are large areas in the Southwest where it should be a valuable addition, and it is intended to give it thorough trial along the Gulf.

VALUABLE PRICKLY PEARS.—Another forage plant of much promise for the warm and arid regions is the thornless cactus, a species of the prickly pear. Enormous quantities of the "pad," or so-called leaves, in reality flattened branches, are yielded, from ten to fifteen tons per acre being often reported. Yielding only from five to ten per cent of dry matter, and thus being a very watery food, the pads are excellently adapted to stock raising in dry regions or seasons, especially where more concentrated food, as cotton seed, is also fed. Varieties of these cacti have been sent from Sicily and others have been obtained from the Argentine. The latter are entirely smooth, even without the minute prickles of the European forms. Both are well adapted for fodder purposes, but the Argentine form also produces delicious fruit, which, however, do not grow if the plant is cut for cattle feeding. In Almeria, Spain, and elsewhere most delicious fruit is raised from the prickly pears, as high as fifteen tons to the acre being sometimes produced. Some of the best sorts have been obtained, and are being distributed to the experiment stations of the Southern and Southwestern States, where they are destined to become a very popular fruit, both for local and shipping uses.

The foregoing is but a brief résumé of the work of one of several explorers under the Agricultural Department's direction; but quite enough is here said to indicate that this fiscal year will be a banner period in the introduction of really promising agricultural experiments.



OTTMAR MERGENTHALER.

THE DEATH OF A GREAT INVENTOR.

In the death of Ottmar Mergenthaler, who died at his home in Baltimore, October 28, America loses one of her foremost inventors, the creator of the "linotype" machine which bears his name. Mr. Mergenthaler was born in Würtemberg on May 10, 1854. His father was a teacher in the public schools of the kingdom and tried to have his son enter upon the same profession, but the bent of the latter's mind was for mechanics, and he spent much of his time in watching machinery in motion and in the study of problems of mechanics. Finally he was apprenticed to a watchmaker, and while learning his trade attended night schools and schools which were open on Sunday. His term of apprenticeship expired in 1872, and to avoid enlistment in the army he came to the United States, landing in Baltimore, and he soon secured a place in Washington where electrical and experimental work was carried on, and most of the necessary experiments on the electrical instruments used by the United States Signal Service were carried out under the direction of Mr. Mergenthaler. He came in contact with many inventors, and soon demonstrated that his life work was to be one of them.

In 1876 he became connected with a mechanical engineering firm in Baltimore, and made his home in that city. A Washington stenographer, named Clephane, who had made a study of writing and printing machines, employed the Baltimore firm to make some models for him, and Mr. Mergenthaler showed such aptitude for the work that he began experimenting on his own account, and for four years he devoted all his spare time to the invention of typesetting machines. His first idea was a rotary machine, with keys for impressing female dies in a continuous strip of heavy paper, which was cut into short lengths for adjustment as the matrix of a column of type. This was superseded by a machine controlling a series of sliding parts, each bearing on one edge all of the characters and spaces. A key mechanism moved these bars endwise, so as to bring a selected character on any bar in line with the selected character on any other, and thus form the matrix of a complete line of casting.

In 1880 he made a complete change of system and adopted the plan which he brought to perfection in the linotype machine, which is used in newspaper offices nearly all over the world. The machine is operated by a keyboard something like a typewriter. These keys set a line of key dies or types, justify them to the exact width of a column or any required measure and cast them into a solid line of type metal. Two machines were built on the same principle, and one was tested in the summer of 1884. It worked smoothly and silently. The matrices slid into their places, were clamped and aligned, the pump discharged its contents, and the finished linotype was the result, the matrices returning again to their normal positions. All this was the work of fifteen seconds. In February, 1885, the second machine with an automatic justifier was completed and put on exhibition in Washington, and was visited by President Arthur, James G. Blaine, and others. The linotype at that time was satisfactory, though not perfect; no tabular work could be done on it, and the operator could not correct an error without discarding all that part of the line which had been formed prior to the discovery of the mistake which had been made. Mr. Mergenthaler set to work to overcome this defect and finally accomplished it.

At first he had difficulty in obtaining capital to manufacture the machines, but finally it was raised, and the machine was finally perfected in 1885. It was arranged so that the line was assembled in view of the operator, and he could make corrections as he proceeded, or he could insert, by hand, any character not carried in the magazine, but the machine could not produce tabular matter. The first of these new machines was installed in the composing room of the New York Tribune in July, 1885, and after this time they came into general use. The 1886 machine required an air-blast for propelling the matrices, and had other imperfections, which Mr. Mergenthaler set himself to rectify. He was weakened by overwork, and he was seriously ill in the fall of 1888. He finally recovered, and the company was reorganized. In 1890, one hundred machines were contracted for. In 1891 there was another reorganization of the linotype company. In January, 1894, the practical method of justification by step justifiers had been devised by Mr. Mergenthaler, and about that time the company bought the wedge justifier, for which it paid $416,000. In 1894, Mr. Mergenthaler's physicians stated that he had consumption, and he was obliged to relinquish personal control of the Baltimore factory. This ended the public life of one of the most remarkable inventors America has ever seen, and to him will be assigned a high place in the annals of the art preservative of arts.

Appendicitis Caused by the Habit of Crossing the Legs.

A foreign surgeon has put forward the suggestion that appendicitis is caused by the habit of crossing the legs, which restricts the action of the digestive apparatus. The appendix is only loosely attached to the cæcum, and there is always some half-digested food in the cæcal bag. By crossing the legs there is liability that the undigested food may pass into the vermiform appendix and set up an inflammation, in a few hours pathological processes set in, and an attack of appendicitis is developed.

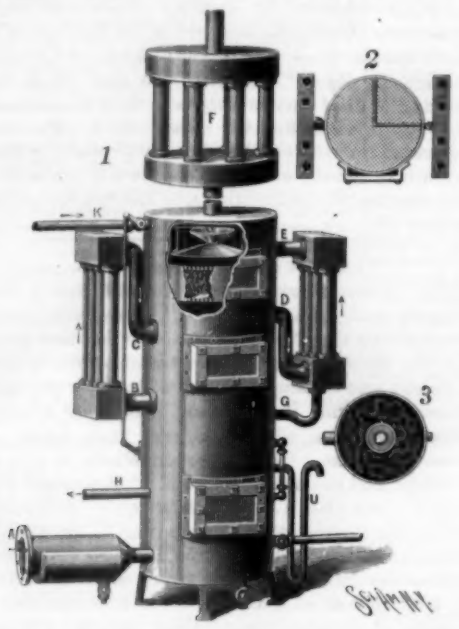
THE engines of a first-class man-of-war cost about $700,000.

A FEED-WATER APPARATUS FOR BOILERS.

An invention patented by John S. Carter, of 483 Fargo Avenue, Buffalo, N. Y., provides an ingenious feed-water apparatus in which the exhaust steam from the engine is made to heat the feed-water, and is at the same time condensed and returned to the boiler. Means for purifying the feed-water and for separating the oil from the exhaust steam are also provided.

Fig. 1 is a perspective view of the apparatus, with parts broken away to show the interior construction. Figs. 2 and 3 are cross-sections through different parts of the device.

The apparatus is inclosed in a cylindrical casing, in the bottom of which is a chamber provided with a



CARTER'S FEED-WATER APPARATUS FOR BOILERS.

blow-out pipe. The exhaust steam enters this chamber through a drum, *A*, fitted with a stationary screw serving to impart a spiral movement to the steam, whereby the oil is centrifugally separated. Leading up from the bottom chamber is a pipe (shown in Fig. 3) perforated near its upper end and provided with a baffle-plate, causing the steam to pass horizontally into a feed-water heating chamber. From this chamber the steam passes through a pipe, *B*, into a condenser comprising two boxes and a number of vertical glass condensing tubes. From the condenser the steam passes down through the pipe, *C*, to a second feed-water heating chamber, from which it emerges by way of the pipe, *D*. After passing through a second set of condensers the steam enters a third feed-water heating chamber in the upper end of the casing, by way of the pipe, *E*. The water of condensation from the second condenser is returned to the first feed-water heating chamber by a trapped or return pipe, *G*. From the third feed-water heating chamber the steam passes through a third condenser, *F*, provided with a vertical outlet pipe. The steam in passing through the various compartments is condensed, and the water of condensation runs back into the casing to be employed as feed-water.

The feed-water is led into the apparatus by means of a pipe, *K*, discharging upon a baffle-plate, from which it passes in a spray to the third feed-water heating chamber and is heated by the steam entering the chamber. The several feed-water heating chambers are separated from one another by means of filtering partitions formed of upper and lower screens, between which filtering material is packed. The water delivered from the baffle-plate passes down through the several screens and filtering partitions in a spray, is heated by the steam passing through the chambers, and finally reaches a reservoir from which it is supplied to the boiler, heated and filtered, by the pipe, *H*. The supply of feed-water in the reservoir is automatically regulated by a float-lever connected by a link with a valve in the pipe, *K*. A water-gage and a trapped overflow pipe, *U*, are also provided for the reservoir. The upper filtering plates or screens, as shown in Fig. 2, are made in two or more sections to facilitate ready removal when cleaning.

PROF. ERNEST HAECKEL, the great German Darwin exponent, was recently thrown from his horse in Rome and seriously injured. He is now 65 years of age.

A SIMPLE DRIVING MECHANISM FOR GINS.

An improvement in cotton-gin driving mechanisms has been devised by Colbert W. Brown, of Leonard, Tex., by means of which the brush is driven practically by the same belt which drives the saws, so as to impart uniform motion to the machine. To the saw-shaft a band-wheel is secured, which is connected by a loose band with a power-wheel mounted below the usual table of the gin-casing. On the brush-shaft a pulley is fastened, connected by a band with a second pulley journaled in a horizontal, forked arm pivoted to a vertical arm swinging on the casing. In order to hold the second band in contact with the first band, a spring is connected at one end with the horizontal, forked arm and at the other end with a screw moving through a stud on the gin-casing, and receiving an adjusting-nut. The tension of the spring may be varied by means of the screw-rod and nut. From the vertical, swinging bar extends a shifting-rod, provided at its outer end with teeth engaging a detent-plate secured to the casing.

When the power-wheel is in motion, the shifting-rod is pulled out to bring the two bands into engagement, and is held in adjusted position by means of the detent-plate. When the first band has been sufficiently tightened, the band-wheel on the saw-shaft and the pulley on the brush-shaft will both be simultaneously rotated, thereby securing an evenness of motion which adds much to the efficiency of the gin.

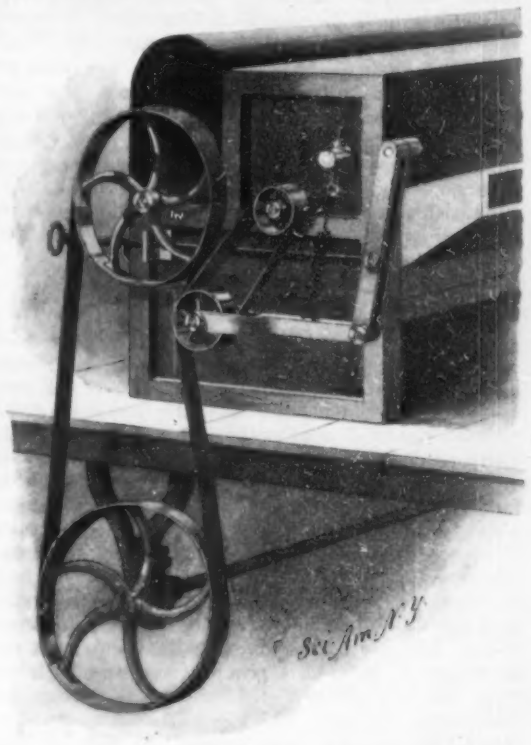
THE "MAESTRO," A NEW PLAYING ATTACHMENT FOR ORGANS.

The "Maestro" is an instrument for correctly rendering, with the aid of an organ, the productions of great composers without necessarily having any knowledge of music. It is not very difficult to play on musical instruments, but it is most difficult to play well, and there are many who are fond of music who wish to gratify this taste without the expenditure of years of practice which have hitherto been necessary. To all such the "Maestro" will be a welcome boon. The instrument is rightly named, for it is, indeed, a "master player," rendering the most difficult music in an acceptable manner, and it also educates the musical taste of the public and helps the beginner who is anxious to become properly educated in music.

The instrument consists of a handsomely finished case, which fits over the keyboard of any organ, and all of the mechanism is contained in this case. It is built in the most substantial and workmanlike manner, in different sizes, in order to fit any standard organ. Brass sockets are attached to the extremities of the keyboard of the organ; screw pins secure the "Maestro" to it, making the alignment and adjustment perfect.

The instrument is manipulated by the turning of the crank shown on the right, but if desired a water or electric motor can be employed. The best results, however, are obtained by turning the crank by hand, as this gives control over the expression and the music is marked to guide the player, so that in no sense can it be called "machine music." The function of the crank is three-fold; first, it serves to wind the roll of music from the reel on to the feed roller; second, it winds up the spring by means of a pinion on the shaft of the reel holder, the power stored serving to wind back the music on to its reel after it has been wound on the feed roller as played; and third, it serves to operate the bellows which exhaust the air from the plungers governing the keys.

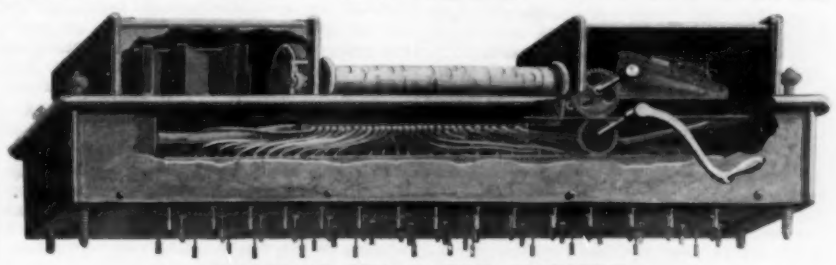
The "tempo" is also controlled by the speed of the crank. The crank shaft terminates in a miter gear meshing with a similar and larger gear attached to the shaft of the feed roller, serving to actuate it to wind the music from the reel over the bridge which controls the plungers. The roll of music is inserted in the front



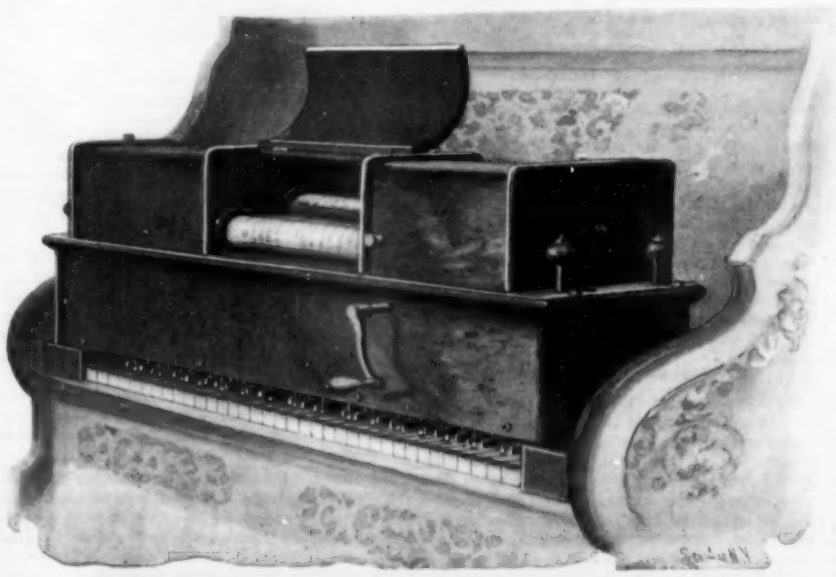
BROWN'S DRIVING MECHANISM FOR GINS.

of the instrument and is unrolled sufficiently to attach it to the feed roller, which winds it up as the music is played. When the piece is finished, the miter gears are thrown out of engagement by means of the pin shown just below the crank and the music is automatically wound on its reel by means of the spring shown on the left, which is wound up by the turning of the reel, the bearing of one end of which is square and adapted to enter a socket in the pinion shaft of the spring train. On the crank shaft is also a toothed wheel which meshes with another wheel to which a pitman is attached. The latter translates the rotary into rectilinear motion and operates the duplex bellows at the left end of the instrument through long sliding connecting rods. The bellows is connected with a reservoir bellows at the right end which serves to equalize the air vacuum.

The bridge consists of a hollow box whose top is perforated by a series of ports which are directly in the path of the dots and dashes in the music strip. A groove extends across the bridge and connects with each air duct by a small aperture; this groove is in turn connected with the vacuum chamber, which is placed at the bottom of the playing mechanism. The vacuum chamber at the bottom is common to all diaphragms which control the plungers. Every note is controlled by a rubber-covered plunger which slides through air-tight nipples and depresses the key, when the proper note is played by means of the music strip. The plungers are connected to diaphragms which move up and down in the body of the lower part of the playing mechanism. The top of each diaphragm is connected with a particular section of the bridge by a small rubber tube. The operation in brief is as follows: A vacuum is constantly kept up by the bellows keeping the plunger out of contact with the keys. This vacuum is constant while the paper passing over the bridge is unbroken, but the instant a perforation opens a port, air is admitted, and as we have already seen, there is also a vacuum at the bottom of the diaphragm by reason of the open passageway which is common to all the diaphragms. Consequently the pressure of air assisted by this vacuum forces the diaphragm down, sounding the proper keys. The mechanism is so simple that it is not likely to get out of order. The construction is very



DETAIL OF THE PLAYING MECHANISM.



THE "MAESTRO," A SELF-PLAYING ATTACHMENT FOR ORGANS.

ingenious and reflects great credit on the inventor, Mr. L. B. Doman, who has spent a number of years in perfecting the "Maestro."

The music can be obtained in great variety including selections from operas, classical music, dance music, songs, church music, hymns, etc., so that every taste can be satisfied. Original compositions or favorite arrangements can be specially made, if desired, the new method of perforating the roll of paper securing the best results, from a musical point of view, with a minimum of expense. The results which can be obtained with the "Maestro" are truly extraordinary, and with a little practice all the variations in tempo can be obtained with a facility and exactness which will satisfy even the critical musician. The field for the instrument is a large one. In the home it is sure to be in daily requisition, and the vast selection of music enables the player to suit each mood. The "Maestro" can be used in churches where no regular organist is employed or in weekly meetings, the most difficult church music as well as simple hymns being acceptably rendered by it. The instrument is made by the Maestro Company, of Elbridge, N. Y.

Death of a Famous Shipbuilder.

William H. Webb died October 30, at New York city. He was not only the most famous shipbuilder in America in the days when sailing vessels still held the bulk of carrying trade, but at the time of his death he was considered as an authority on the art of ship construction. His father had been a builder of sailing vessels in the days before the construction of Fulton's first steamboat, and the adoption of steam opened a new field for Mr. W. H. Webb. He was born in 1816 and entered his father's shipyard, which attained a national reputation during the war of 1812. The son soon began to show great knowledge of ship construction and he proved himself a born mathematician. He constructed the first steamship that ran between New York and Savannah, and New York and New Orleans, the first steamer for the Pacific Mail Steamship Company, and the first steamer to enter the Golden Gate was built by him. In 1859, he built a powerful screw frigate for the Russian government which was the fastest man-of-war known at the time. During the civil war he built several ironclads. He was also the designer and builder of the Fall River steamers "Bristol" and "Providence." In 1872 and 1873, he retired from active business, but has always taken a great interest in shipbuilding matters since that time. In 1889, he built the Webb Academy and Home for Shipbuilders to afford free and gratuitous aid, relief and support to the aged, indigent or unfortunate men who have been engaged in building hulls of ships, or marine engines, and also to provide young men with an education in the art of shipbuilding, both theoretical and practical. This academy is situated at Fordham, and is a well-known landmark, and was described in the SCIENTIFIC AMERICAN for February 24, 1894.

Automobile News.

A Paris newspaper publishes some statistics which show that in a certain period only 1 death and 33 injuries were caused by automobiles, and during this time, 67 deaths and 745 injuries were caused by vehicles drawn by horses.

The greatest trouble with the pneumatic tire on heavy vehicles is not caused by puncturing, which accounts for only about seven per cent of the trouble, but results from the internal wear of the fibers of the tire, due to the weight. Some tires which have been examined show the fibers of the material reduced to a fine powder.

This year in Germany traction motors were used for the provisioning of columns, and although the roads through the Black Forest were very steep and in places very bad, the experiment was most successful. There were exceedingly few accidents and the motors effected a great saving in both men and horses. It appears to be perfectly adapted to a country traversed by numerous roads.

The police sergeant who has charge of the boiler inspection squad of New York city has sent a communication to the Board of Police Commissioners saying that he had been informed that a parade of automobiles was to take place and that several of these vehicles would be equipped with steam boilers. He wished to know if the boilers would have to be tested and if they must be in charge of duly licensed engineers. The commissioners considered it would be a violation of the law if the boilers were not tested and the men in charge were not duly licensed. It will be interesting to see the outcome of this matter. It will probably be decided that the horse power is too small to be considered.

A few days ago Mr. Winslow E. Buzby was arrested for attempting to drive an automobile through Central Park, New York city. Mr. Buzby's idea was to make a test case of his arrest, considering that automobiles were wrongly excluded from the park. He was promptly arrested and brought before a magistrate. He was discharged after a hearing, and announced his intention of again presenting himself at the park entrance in his automobile, and if he is again arrested he will bring a suit for heavy damages. Mr. Buzby is backed by the Automobile Club, which is fast becoming an influential organization. The Park Commissioner does not consider it was a test case, and does not recognize automobiles as pleasure carriages. It is a question of only a few weeks, or months, at most, when the Park Commissioners will be forced to allow automobiles to enter the park, whether they wish it or not, and legislation can be easily obtained. Their attitude is extraordinary, in view of the fact that in Paris there are undoubtedly more automobiles in the Bois de Boulogne than there are horse-drawn vehicles.

The November Building Edition.

The November number of the Building Edition of the SCIENTIFIC AMERICAN is of great beauty. "The Castle of Vincigliata" is the subject of two large engravings showing the interior of a medieval castle which has been elaborately restored. "Some Formal Gardens of Newport" is by Miss Margaret La Farge and is accompanied by beautiful engravings showing some of the interesting features of the gardens of Newport's famous villas. "A Modern House of Learning at Springfield, Mass.," describes the new High School building of that city, which is a very handsome and well-equipped edifice for school work. The houses illustrated in this number are particularly attractive and are in great variety. The literary contents deal with the Hearst competition and Moore's Gothic Architecture.

The Current Supplement.

The current SUPPLEMENT, No. 1245, has a number of most interesting articles. "Count von Zeppelin's Dirigible Air-Ship" is the subject of the first-page engraving, showing the huge air vessel, which is 500 feet in length and is being built on a float on the Lake of Constance. This is the most ambitious attempt at aerial navigation which has ever been made. "Mechanical Science," by Sir William White, is a most interesting and important address. "Roquefort and Its Cheese" describes a unique industry. "Intarsia" describes the process of wood-inlaying. "Stream Measuring in the United States," by F. H. Newell, describes some of the important work which is being carried on by the Geological Survey. It is accompanied by a number of illustrations. "Mind and Morals in Animals" is an article by O'Neill Daunt and is very interesting. "The New Automatic Pistol of the German Army" describes in detail the new weapon.

Contents.

(Illustrated articles are marked with an asterisk.)

RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

PLOW.—FRANKLIN H. DAWES, El Reno, Oklahoma Territory. This plow is particularly adapted to localities where the rainfall is limited, and is designed to loosen and level the soil without turning under the crust of dry soil, as is done with the moldboard of the plow, so that when the grain is sown it will be placed directly in the moist soil. A scaling or surface share is provided having a vertical cutter at the landside so shaped that it will turn the soil away from the beam. Adjustable teeth at the rear of the share loosen the soil as it passes over the share and back into the furrow.

GRAIN-ROLLER.—EMANUEL BEDO, Woodland, Cal. On the Pacific Coast standing crops are often destroyed by the severe storms which prevail during spring and summer. With the object of preventing the loss of the crops, this inventor has devised a simple machine which rolls the grain down without breaking it at the roots and without interfering with its growth. Thus leveled, the grain can ripen properly without injury by the storms mentioned.

Bicycle-Appliances.

BICYCLE-SUPPORTER.—HENRY VANDER WEYDE, 182 Regent Street, London, W., England. The appliance comprises a pair of levers on the lazy-tongs principle, normally contracted into a very small space, but capable of being projected down to the ground. The upper pair of levers is attached to the frame, the one lever by a pivotal, the other by a sliding connection. A coiled spring tends to extend the lazy-tongs, and a pawl and rack prevents the supporter from collapsing under the superposed weight. The lazy-tongs are independent as regards their relative amount of extension; but they are simultaneously operated by means of a cord, which permits the detent-pawls to slip over and engage or disengage the racks, so as to project or contract the lazy-tongs.

Engineering-Improvements.

VALVE.—LOUIS GASZ, Brooklyn, New York city. The valve is designed to govern the passage of steam to the steam-cylinder of a direct-acting steam-pump. The invention comprises a steam-cylinder on which an auxiliary cylinder is mounted, both cylinders having pistons. A main valve is operated by the auxiliary piston for governing ports between the two cylinders. An auxiliary valve in a valve-cylinder on one end of the auxiliary cylinder puts two ports leading from the valve-cylinder to the auxiliary piston-cylinder into communication, and has ports through its opposite ends and sides for connecting with ports leading from the auxiliary valve-cylinder to the opposite ends of the auxiliary piston. The auxiliary valve is shifted by the action of the piston in the steam-cylinder and is prevented from rotating.

PUMP.—RICHARD LUHN, Haspe, Prussia, Germany. The invention is an improved *monte-jus*, that is to say, an automatic apparatus for raising liquids, which is adapted alternately to take in and eject a body of liquid by the action of a due and continued pressure of air or steam, which is intermittently admitted and cut off by an automatic valve and float mechanism. The apparatus is composed of a tank or main working-vessel and exterior float and valve attachments to the side and top of the tank, which attachments are of novel construction.

ROTARY ENGINE.—FERDINAND KRUEGER, Berlin, Germany. The rotary engine comprises a casing with an annular chamber at its periphery communicating with a radial chamber. Packing-chambers are located laterally of the radial chamber and receive packing-rings. An inlet leads into the annular chamber to admit the steam. Rigidly connected with the piston, revolving in the annular chamber, is a disk rotatable in the radial chamber. A packing surrounds the piston and is held against turning relatively thereto. Means are provided for controlling the admission and exhaust of the steam. Channels lead behind the piston packing-ring from the back or outer portion of the lateral chambers to the annular chamber, in close proximity to the steam inlet.

Mechanical Devices.

LINOTYPE-CASTING MACHINE.—HENRY J. DERBYSHIRE, Columbus, Ohio. This improved machine enables one or more lines of type of equal or different lengths to be cast at one time, dislodgment of the cast lines by the pot being prevented, in case the metal has become chilled. The machine has a mold-wheel carrying a mold provided with a slot, one wall of which is perpendicular to the plane of the wheel, while the opposite wall is inclined. A movable, wedge shaped mold-member fits into the slot and is provided on the face opposite its inclined face with ribs dividing the mold-cavity into a series of line-spaces.

Miscellaneous Inventions.

BASKET.—JOHN W. DOERFLINGER, Sandusky, Ohio. This basket for shipping perishable goods comprises splints interlocked at their middle portion to form the bottom of the basket, the free end of the splints being bent at right angles to the bottom portions to form sides. The splints are spaced for ventilating purposes, and are secured by their tops between inner and outer top bands. Handles at the upper ends of the splints form opposite sides and are held in place by the outer band. By the use of reinforcing strips the bottom is ventilated even though the basket rest on the ground.

SMELTING-FURNACE.—JOHN H. CANAVAN, Kirkland, Arizona Territory. The invention provides a furnace for smelting pyrites or other metallic ores, carbonaceous fuel not being required after the fire is once started. Within an outer shell or casing a cupola is arranged having a water jacket and a chimney. The outer shell and the walls of the cupola and chimney form walls of hot-air chambers open at the bottom. Forehearths are movable underneath the hot-air chambers, are surrounded by water-jackets, and are mounted on trucks. Tuyères extend into the cupola at opposite sides and communicate with air-blast pipes in the hot-air chambers. The upper end of the pipes communicate with air-boxes into which air is discharged.

BOX AND MEANS FOR HANDLING CEREALS.—JOHN WESTOVER, David City, Neb. The object of the invention is to provide boxes or packages for grain, which boxes readily fit into a wagon body. The arrangement for manipulating the boxes consists of an elevated track with a buffer-surface, upon which track a truck travels, carrying a hoisting-drum. A windlass on the track detachably engages the drum. The box used is provided with a drop-bottom and is connected with the hoist-ropes carried by the drum. The box has a locking latch, one member of which extends outward from the box, the outer portion of the latch being adapted for engagement with the buffer to release the drop bottom.

VEHICLE-HUB.—ELMER MCHUGH, Lambertville, N. J. The invention provides means whereby an elastic cushion forms part of the hub or constitutes a yielding bearing for the axle or a yielding connection between the inner surface of the hub and the axle. The cushion relieves the wheels from the jar incident to the usual mountings. The cushions may be solid or pneumatic and do not interfere with the ready removal of the hub.

APPARATUS FOR SEPARATING SULFUR FROM ORES.—JAMES B MCCABE, Buffalo, N. Y. The apparatus comprises a boiler adapted to contain a heated liquid and a perforated ore-cylinder mounted to revolve in the boiler and having hollow trunnions forming inlet and outlet. The outlet-trunnion extends nearly to the center of the cylinder and has a lateral outlet. The material passed into the cylinder can be subjected to a rolling motion by revolving the cylinder so that the material comes into contact with the heated water to cause a complete melting of all the sulfur in the ore.

COOK-STOVE.—MARGARET KENNEDY, Fredonia, Ill. The stove, although adapted both to baking and frying, may be so operated as to provide no more heat than is necessary to the work in hand, thus avoiding the heating of the oven when it is desired only to fry or boil. This end is attained by constructing the stove with two fire-boxes, over one of which the oven is arranged in a manner to gather from the fire-box all of its heat. Over the other fire-box removable lids are placed, so that food may be dried and boiled thereon.

SQUID.—HERBERT A. HOWARD, Huntington, N. Y. This squid for use in trolling for fish is of simple and inexpensive construction and has barbs adapted to be forced outward to engage in the jaws of a fish upon the fish's taking the squid. The barbs may be easily disengaged without the necessity of taking hold of the fish.

ACETYLENE-GAS GENERATOR.—GASTON A. HERVIEU, Nauterre, Seine, France. The apparatus comprises essentially a generator; a water-reservoir or tank, together with a gasometer-bell; an automatic distributer operated by the bell; a device for the carbid, placed within the generating-receptacle; a receptacle for first receiving and then carrying off the residues left by the spent carbid; and a mechanism operated by the bell for ejecting the residues. These different parts, as a whole, operate in a well-defined manner, their essential characteristic being that they are absolutely automatic, both in the matter of feeding the carbid and evaporating the residues.

DEVICE FOR CONNECTING TUBES.—ALBERT FLORIN, Berlin, Germany. The invention provides a means whereby branch tubes can be easily connected with the main tube in gas or water conduits. For this purpose the end of the branch-tube to be connected is pressed directly against the main tube, which is provided with a suitable opening in the respective portion of its wall.

DOOR.—JOHN NASH, Dayton, Wash. The door is constructed in adjustable sections, which can be assembled exactly to fit the frame, thus enabling doors of all sizes to be constructed more easily and cheaply than heretofore. The door is strong and rigid; and the parts may be tightened together at any time to compensate for shrinkage.

Designs.

PUZZLE-BOARD.—JAMES M. MONTGOMERY, Manhattan, New York city. The puzzle-board represents an American flag, the stripes of which are provided with openings. The puzzle consists in rolling a ball so that it will pass through the openings and lodge in the field of stars.

BUCKLE-FRAME.—WALTER DOWNING, Keota, Iowa. The buckle-frame is especially intended for use on bridles, being adapted by means of its opposite studs and several loops for the connection of the throat-latch and crown billet.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(7754) W. H. K. asks: What solid fuel would you recommend as being applicable to the running of a light steam automobile? And how would it compare in time required to get up steam and in bulk to be carried with kerosene or naphtha? A. Of solid fuels we recommend anthracite nut coal for vehicle boilers. It does not ignite quite as easily as pulverized coke, but will last longer in the furnace and needs less care. The hard anthracite makes the best and most reliable feed for a magazine furnace. Coke is much used in Europe, where soft coal is the principal fuel. Coal from a magazine is preferable to kerosene or gasoline burners in many ways, especially in regard to odor. On the other hand, the kerosene may be the easiest to control and to obtain from any grocery or country store. From the moment of firing steam can be raised much quicker with kerosene or gasoline burners than with coal or coke.

(7755) E. A. W. asks how to take care of a marine boiler during winter while it is stored away. My boiler is a 10 horse power Scotch marine. A. Charge the boiler with three gallons of kerosene oil, either through the pump with steam sufficient to run the pump, and then pump the boiler nearly full of water with as tow steam as will run the pump. Then, after drawing the fire, blow off the boiler and clear the pump, pipes and the legs of the boiler of water and excess of oil by opening the lowest hand hole. Then close the boiler air tight. This will leave an oiled surface over the entire interior of the boiler, and the exclusion of air will prevent rust.

(7756) A. W. H. asks: 1. Where was the "Shamrock" built? A. "Shamrock" was built on the Thames by Thornycroft. 2. Is the "Navahoe" a keel or centerboard boat? A. "Navahoe" is a centerboard boat. 3. Did the Queen of England give the yacht club the "America" cup raced for in 1851? Is it rightly called the queen's cup? What I mean is did the queen give to the Royal Yacht Squadron the cup which they offered in 1851, to be raced for by the yachts of the world? A. The queen did not give the cup. She did give a cup, but the "America" did not enter the race for this cup as time allowance would have had to be given. The cup she did sail for and capture was given by the R Y.S., and was sailed for without the customary time allowance.

(7757) M. W. asks for a receipt for burn- ishing ink used for blacking the edges of heels and soles of shoes. A. Receipts for burnishing ink for heel and sole edge polishing:

a. Extract of logwood	1 to 2 oz.
Tincture of iron	1 to 2 oz.
Sweet oil	1 to 2 drm.
Diluted alcohol	1 pint.
b. Extract of logwood	4 oz.
Bichromate of potassium	12 grn.
Ferrocyanide of potassium	12 grn.
Rain water	1 gal.

The ink in either case is applied with a brush and immediately burnished with a hot iron.

NEW BOOKS, ETC.

THE FIREPROOFING OF STEEL BUILDINGS. By J. K. Frietag, C.E. New York. 1899. 8vo. Pp. 319. Price $2.50.

The want of any systemized and collected form of information on the subject of the development of fireproofing of steel buildings and its present most approved and efficient methods of treatment as recommended and used in the best practice of the day, has induced the author to offer this volume, which we have no hesitation in saying is a most valuable one, which no architect or architectural engineer can afford to be without. Steel buildings are comparatively a new departure, and the literature relating to them in book form is slight, though the articles on it in periodicals are voluminous. The present volume has many well executed illustrations detailing the latest and best methods of fireproofing steel structures. It is an important contribution to engineering literature.

DICTIONARY OF BIRDS. By Alfred Newton. Assisted by Hans Gadow. London: Adam & Charles Black. New York: Macmillan Company. 1893 to 1896. Pp. 1088. Price $5.

A most admirable book filled with valuable information presented in the most usable form. It is well illustrated by wood engravings. Not only are the birds themselves listed and described but there are valuable sections devoted to such subjects as the "Muscular System," "Nervous System," "Nidification," "Quill," etc. There are four pages of "Notanda et Corrigenda," and it is gratifying to see that the authors have not been ashamed to place their errata in a prominent position. No greater service can be rendered to a scientific book than this, and it is impossible in a scientific book of this size not to have many corrections.

COMPULSORY LICENSES UNDER THE PATENT ACTS. By J. W. Gordon. London: Stevens & Sons, Limited. 8vo. Pp. xxxv, 443.

This book is a compendium of the British law and practice relating to the grant of compulsory licenses for the manufacture and sale of patented articles. The intention of the legislators was to prevent owners of patents from withholding the benefits of their inventions from the public, and to compel them to supply the demand that might exist for the patented goods, and to provide a legal procedure to determine the conditions under which a patentee should grant a compulsory license. The Board of Trade, to which such matters are referred under the law, has rendered several important decisions defining the right of the public in patented inventions. Mr. Gordon's book is a clear and exhaustive statement of the law and practice of compulsory licenses.

THE RISE AND DEVELOPMENT OF THE LIQUEFACTION OF GASES. By Willett L. Hardin, Ph.D. New York: The Macmillan Company. London: Macmillan & Company, Limited. 1899. Pp. 250. Price $1.50.

Recent developments in the liquefaction of air and the recent liquefaction of hydrogen have added considerable interest to the whole subject of the liquefaction of gases. The literature of the subject is limited and is scattered for the most part in foreign journals. It has been the author's pleasant task to collect these papers and write a complete history of the developments of the methods employed in the liquefaction of gases. The book is written in a popular science style, but at the same time scientific accuracy has not been departed from in any degree. It will prove useful to those who already have Sloane's "Liquid Air."

PROBLEMS IN MACHINE DESIGN. By Charles H. Innes, M.A. Second Edition. Manchester: The Technical Publishing Company, Limited. 1899. Pp. 258. Price $1 60.

There never can be too many good books upon this subject; the mechanical engineer is always needing precisely the kind of information which is given in this work. We regret to note that the object of the author in writing this book is to supply engineering students with a text book which will enable them to pass the honor stages of the science and art examinations. We sincerely trust that it will appeal to a much larger public.

A COURSE IN QUANTITATIVE CHEMICAL ANALYSIS. Gravimetric and Volumetric. By Nicholas Knight. New York: A. S. Barnes & Company. 1899. Pp. 110. Price 80 cents.

Complete analyses are outlined in this book, and substances have been selected for analysis which it is believed will illustrate the more common methods of separating and determining the parts of a compound or mixture of compounds. This treatise will contribute to a knowledge and love of this beautifully exact, fascinating and useful branch of chemical science.

NOTES ON THE CONSTRUCTION OF CRANES AND LIFTING MACHINERY. By Edward C. R. Marks. New and Enlarged Edition. Manchester: The Technical Publishing Company, Limited. 1899. Pp. 183. Price $1 40.

A modern and practical book on cranes and other lifting machinery has been needed. It is a much neglected part of mechanical engineering and the present book will certainly prove most valuable to those who have to design such machinery.

A KEY TO ENGINES AND ENGINE RUNNING. By Joshua Rose, M.E. New York: D. Van Nostrand Company. 1899. 12mo. Pp. 410. Price $2.50.

This is a practical treatise on the management of steam engines and boilers for the use of those who desire to pass an examination to take charge of engines or boilers. It also includes instructions upon engines, calculations, indicator diagrams, engine adjustments, and contains other valuable information necessary for engines and firemen. The author was an old-time contributor to the SCIENTIFIC AMERICAN and he had an excellent reputation as a practical mechanical engineer. The book will prove of value to the class to whom it is addressed.

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Puzzle, H. A. Towers	636,109
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Refrigerating system, H. Torrance, Jr	635,882
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Riveting machine, W. P. Bartel	636,103
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Shade adjuster, window, H. M. Sturgis	636,082
Shafts, means for securing crank arms to, J. Gillet	635,766
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Spoke socket, Killinan & Potter	635,785
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Steam boiler, J. T. Fanning	635,925
Stone sawing machine, J. S. Young	636,004
Storage battery, Heinemann & Schafer	635,774
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Strainer, J. J. Murphy	636,054
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Stylus for producing illuminated sentences, J. Scott	635,814
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Suspenders, W. Freeman	635,959
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Telephone call register, W. Gray	636,134
Telephone pay station coin holder, W. Gray	636,135
Telephone transmitter arm, L. Schmidt	635,812
Telephonograph, J. E. O. Kumberg	636,209
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Thread cutting tool, S. W. Vandegrift	635,987
Threshing machine, M. & J. Bowman	635,742
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Tire, bicycle, P. Pitton	636,051
Tire, elastic, W. F. Beasley	636,104
Tire setting machine, rubber, J. A. Burrows	635,914
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Tire valve, bicycle, D. R. Camp	635,915
Tongs, pneumatic, A. A. Landon	636,225
Tool, combination, W. D. Arnot	636,098
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Toothpick polishing and rounding machine, W. H. Dyer	635,756
Top, L. Biddle	636,108
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Vessel hulls, means for cleaning, D. Mason 635,098
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Wire stretcher, J. S. Smith 636,075
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Badge or similar article, J. W. Mealy 31,730
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Collar and cuff smoother, H. Grenon 31,755
Cracker or biscuit, L. Fox 31,777
Cutter frame, S. K. White 31,751
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Dish, W. H. Grindley 31,740
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Gas purifier, B. E. Chollar 31,754
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Steam table, C. R. Holden 31,757
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Tongs, member for pairs of, P. A. Malmberg 31,746

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Axle grease, H. A. Moyer 33,672
Ball retainers, Star Ball Retainer Company 33,674
Beer, ale, and porter, lager, Consumers Park Brewing Company 33,658
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Combs, hair, Hannoversche Gummi-Kamm-Compagnie Actien Gesellschaft 33,646
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Paints ground in oil, Mound City Paint and Color Company 33,673
Photographers' supplies, certain named, W. F. Carlton 33,641
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Soap, R. L. Hall 33,661
Sugar, American Sugar Refining Company 33,651
Tires, International Automobile and Vehicle Tire Company 33,675
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"**Flame Proof Starch,**" for starch, Flame-Proof Company 7,187
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"**Quabaug Spring Water,**" for spring water, Quabaug Spring Water Company 7,191
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